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"The work of science is to substitute facts for appearances and demonstrations for impressions."—RUSKIN.

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NOTATION

Life Symbols.

As Revised October 11th, 1911.

Resolved, that in the presentation of papers the symbols of the Text-Book of the Institute of Actuaries, with the additions noted below, be followed when convenient, and that, in any event, the use of such symbols in other senses be avoided; all letters used as symbols to be printed in italics except "a" when used to denote an annuity of 1 first payment immediate, *i. e.* $(1+a)$; that N_x and S_x be used in accordance with the practice of the Institute of Actuaries, *i. e.*,

$$N_x = N_{x-1} = D_x + D_{x+1} + \cdots$$
$$S_x = S_{x-1} = N_x + N_{x+1} + \cdots$$

Additional symbols

$$k_x = \frac{d_x}{l_{x+1}} = \frac{C_x}{D_{x+1}}.$$

$$u_x = \frac{l_x}{l_{x+1}}(1+i) = \frac{D_x}{D_{x+1}}.$$

Disability Symbols.

As Adopted May 16th, 1912.

l_x^{aa} = the number of active lives at age x.
l_x^{ii} = the number of invalid lives at age x,

then $l_x^{aa} + l_x^{ii} = l_x$.

l_x^{i} = the survivors at age x in a mortality table based on invalid lives (not to be confused with l_x^{ii} amongst whom there are additions each year from those just disabled).

d_x^{aa} = the number dying as active lives between ages x and $x+1$.

d_x^{ii} = the number dying as invalid lives between ages x and $x+1$.

i_x = the number of active lives becoming invalid between ages x and $x+1$.

p_x^a = the probability of an active life aged x being alive one year hence, whether then active or invalid.

q_x^a = the probability of an active life aged x dying within a year, whether still active or after becoming invalid,

$$\text{then } p_x^a + q_x^a = 1.$$

p_x^i = the probability of an invalid life aged x being alive one year hence.

q_x^i = the probability of an invalid life aged x dying within a year,

$$\text{then } p_x^i + q_x^i = 1.$$

p_x^{aa} = the probability of an active life aged x being alive and active one year hence.

p_x^{ai} = the probability of an active life aged x being alive but invalid one year hence.

q_x^{aa} = the probability of an active life aged x dying while still active within a year.

q_x^{ai} = the probability of an active life aged x becoming invalid and dying within a year.

r_x = the probability of an active life aged x becoming invalid within a year,

then $p_x^{aa} + p_x^{ai} = p_x^a$; $q_x^{aa} + q_x^{ai} = q_x^a$; $p_x^{ai} + q_x^{ai} = r_x$; $p_x^{aa} + q_x^{aa} = 1 - r_x$; $p_x^{aa} + p_x^{ai} + q_x^{aa} + q_x^{ai} = 1$.

r'_x = the absolute annual rate of invalidity,

$$\text{then } r'_x = \frac{i_x}{l_x^{aa} - \frac{1}{2}d_x^{aa}} = \frac{r_x}{1 - \frac{1}{2}q_x^{aa}}.$$

$D_x^{aa} = v^x l_x^{aa}$.

$D_x^{ii} = v^x l_x^{ii}$.

$D_x^{i} = v^x l_x^{i}$.

a_x^{ai} = value of an annuity payable at the end of each year

provided an active life now aged x is then alive but invalid.

$\mathbf{a}_x^a$ = value of an annuity-due on an active life payable during survival, active or invalid.

$\mathbf{a}_x^{aa}$ = value of an annuity-due on an active life payable during activity.

$\mathbf{a}_x^i$ = value of an annuity-due on an invalid life.

${}_n|\mathbf{a}_{x\,t|}^{a(\overline{in}|)}$ = value of a deferred temporary annuity payable at the beginning of each of t years deferred n years, provided the disability occur during the n years.

$\mathbf{a}_{x\,:\,\overline{n}|\,:\,\overline{y-x}|}^{\overline{aa}}$ = value of an annuity-due on an active life for n years or for $y-x$ years, whichever is the shorter, during activity.

Vol. XXIII, Part One. No. 67

TRANSACTIONS

MAY 18TH AND 19TH, 1922.

Address by the President, William A. Hutcheson.

Mathematical Training

versus

Statistical Fallacies.

I am conscious of the fact that we have a very full program before us today and tomorrow, but I nevertheless wish to avail myself of the privilege, granted me under our by-laws, of making a few remarks to you this morning on a subject which is of interest to us as actuaries.

Through our preliminary study of mathematics in our student days, and our practical use of mathematical principles in our daily business we are trained to analyze figures, to draw logical conclusions from them, and to detect incorrect or illogical conclusions when we meet them in our daily life. We are appalled by the number of errors and fallacies that stare us in the face, and I sometimes wonder if we are not neglecting our duty when we fail to expose them. It would be a gigantic task, but, if we undertook it, our influence would be felt, and such an influence is especially needed at present.

Fallacies of Statistics.

The improper handling of statistics is so general that we have almost ceased to expect anything else, and it has brought the use of statistics into disrepute. Sometimes the statistician is biased, and his interpretation is altogether dishonest; at other times the statistics are dealt with honestly, but by incompetent amateurs. Not infrequently the fundamental data are insufficient for drawing conclusions; sometimes the conclusions are influenced by temporary

causes or by conditions which no longer exist; at other times they are actually incorrect. If we enumerate those who draw improper conclusions from statistics, their name is legion—laymen, pure and simple; politicians; reformers; newspapermen; life company employees, and others without end. Sometimes they ought to know better; often they do not, and in these cases, absence of analytical power, or lack of logical reasoning, lies at the bottom of their errors.

Here are a few examples for illustration:

Aggregate Death Rate.

A not uncommon error is to state that one locality, a city perhaps, is healthier than another, because the death rate is lower in the former than in the latter. The death rate used in this comparison is the aggregate death rate for all ages combined, *i.e.*, the total deaths of a calendar year divided by the total population. We know, of course, that the aggregate death rate has no meaning, and that the only proper comparison to make is a comparison of death rates by ages or age groupings, for the distribution of population by age groups may be entirely different in the two localities. The locality with the smaller aggregate death rate might possibly show larger death rates, age group for age group, if its population happened to have relatively few infants or people of advanced ages, at which periods of life the death rates are much higher than in middle life.

Estimated Population.

In this comparison, very probably another error has been committed. Our census is taken each tenth year, and for intercensal periods the population of individual cities is estimated; when the next census is taken, the estimated intercensal populations are nearly always found to have been erroneous, due to the migratory nature of our population, and thus, of course, the intercensal death rates have been correspondingly incorrect.

Migration.

At the present time it is very necessary to point out that entirely erroneous conclusions may be drawn from these intercensal estimates of population, because in many districts the population is at present subject to violent changes through migration, in and out, which changes, in turn, are due to the post-war depression or changes in many industries: men and women are "laid off" in great numbers and migrate in search of work elsewhere.

A risky procedure, followed by one of our Government Departments during and after the war, was to estimate the annual death rate by taking the deaths for a week and by assuming that the deaths for the whole year would be in proportion to those for the period in question. This was done during the 1918–1919 influenza epidemic. Even in normal times deaths, as we know, are not evenly distributed throughout the year.

Average Age at Death.

Another common case of fallacious reasoning occurs when it is assumed that because the average age at death in some community or in some profession is high, the community or the profession, as the case may be, is healthy. This error is due to ignorance of, or to purposely ignoring, the fact that the death rate is high at infancy, decreases for some years, and then gradually mounts again with increasing age. Unless the death rates, in the two communities or professions, are analyzed by ages, no conclusion can be drawn from average ages at death.

Centenarians.

One more illustration from vital statistics. We constantly find it stated that there are many centenarians, but investigation shows that evidence as to dates of birth is, as a rule, sadly lacking. Old people have a habit of boasting of their ages, and investigations in all countries show that the more ignorant they are the more likely they are to overstate their age.

The United States Census showed, per 100,000 of *white* population, 4 centenarians in 1850 against 1 in 1910; and, per 100,000 of *negro* population, 49 centenarians in 1850 against 27 in 1910. In 1910 there were 5 illiterate whites per 100,000 whites of 10 years of age and over, whereas there were 30 illiterate negroes per 100,000 negroes of the same ages. The conclusion to be drawn from the census figures as to centenarians is not that more negroes than whites reached that age, but that more negroes than whites overstated their ages.

Registration of Births.

While on this subject of vital statistics, it is well to call attention to the utter inadequacy of our system of registration of births; this is all the more to be regretted, as the United States was the first nation to adopt the taking of a census as part of its Constitution and fundamental laws. The whole system of life insurance depends upon the assumption that the premiums paid are those for the correct ages, and unfortunately it is but seldom that we can get an official certificate of

birth from a registrar of births, verifying the age stated in the application.

Reformers.

As an instance of misuse of statistics by reformers, let us take a statement of the General Counsel of the Anti-Saloon League of America, which appeared a month ago in one of the New York newspapers under the title "What Prohibition has Done." He catalogued certain benefits which he stated may be said to flow directly from prohibition (which, be it remembered, went into effect in January, 1920), and others, equally great or greater, to which it indirectly contributed. Two of the alleged benefits cited by him will be sufficient for our purpose.

The first of them is that "Life insurance statistics disclose an enormous increase in the amount of insurance in force, indicating a deeper appreciation of the responsibility for the care of dependents." As prohibition went into force early in 1920 he must refer to the "enormous increase" in the amount of insurance in force in 1920 and 1921 as compared with earlier years. These increases were due, *inter alia,* to the abnormally large amount of new business written by the various life companies in 1920 and 1921, and to the smaller amount of insurance lapsed, as well as to the smaller amount of death claims. Post-war inflation of our currency, high wages and large profits were some of the factors responsible for the large new business and the small amount lapsed in 1920, just as adverse trade conditions, strikes, loss of employment and general retrenchment were responsible for the decrease of new business and the large amount lapsed in 1921. It is a poor argument that doesn't work both ways; if the favorable conditions of 1920 were due to prohibition, then prohibition was also to blame for the poorer conditions of 1921, for in that year the increase in insurance in force was much less than in 1920. Perhaps the writer saw the fallacy of his reasoning, for he omits this statement in an article in the *New York Times Current History* for May, 1922, entitled "Facing the Facts of Prohibition," in which he states that "Facts, not theories, are interesting to hard-headed Americans."

His second statement in the newspaper article, which is repeated in substance in the other article just referred to, is that "Thirty-seven leading insurance companies, which transact 80 per cent. of the life insurance business of the country, show that the death rate among policyholders has been reduced from 9.8" (the authority from which he quotes stated 9.58) "per thousand in 1920 to 8.24

in 1921." The reasons for the decreased rate are obvious: First, we had an influenza epidemic in the early months of 1920, which caused the death rate of that year to be high; we had no such epidemic in 1921. Second, an abnormally large amount of new business was written in 1920, and the death rate on this insurance was low in 1921, as we would expect in the first year after selection.

As a matter of fact, the prohibition laws went into force in January, 1920, and they were immediately followed by an epidemic of influenza and pneumonia which caused many deaths amongst policy-holders. These two facts followed each other in close succession, but prohibition was no more responsible for the high death rate of early 1920, than it was for the lower death rate of 1921, or, for that matter, for the higher death rate of 1922 to date.

There are no prohibition laws in Great Britain, and yet there the death rate of the whole population was lower in 1921 than in 1920, which was the previous lowest on record.

It is very probable that the influenza epidemics of recent years thinned out some of the weaker elements in the populations of both the United States and Great Britain. If this be so, the death rates of years immediately following these epidemic years would be lower than usual.

Excessive drinking leads to high mortality, but reformers weaken their case when they misuse statistics, and ignorance is no excuse for broadcasting fallacies.

Fallacies about Life Insurance.

If we turn to our own business of life insurance we see that it, too, is not free from fallacies.

Perhaps the first is the popular belief that insurance is bought, whereas we all know that for every policy *bought* "over the counter," thousands are *sold* through the solicitation of agents.

One fallacy prevailed especially among legislators, that the excess of receipts from premiums over disbursements for claims and expenses was surplus; reserves were unknown. The mention of reserves leads naturally to the erstwhile theory that insurance could be conducted successfully and permanently on the assessment basis; history has demonstrated the fallacy of this theory.

Another fallacy we meet frequently amongst policy-holders is that premiums paid are investments, pure and simple; that when their policies mature as endowments or are surrendered, they should get back their premiums with compound interest thereon. The cost of the term-insurance granted is beyond their comprehension, although I have yet to meet a beneficiary under an early death claim who does not appreciate the insurance element.

Insurance not Investment.

That misnomer, that excrescence, the expectation of life, is responsible for at least three fallacies; first, that the expectation of life is the time any one individual is *likely* to live; second, that, at each age, the value of a life annuity is equal to the value of an annuity-certain for a term equal to the so-called "expectation of life"; and, third, that actuaries use the expectation of life in calculating premiums.

Expectation of Life.

Closely allied to the first of these fallacies, is the other, that the granting of an endowment insurance policy, where a life policy is applied for, is equivalent to rating up the risk.

Instances of the misuse of ratios when comparing certain facts in different life companies are too numerous to detail. The ratio of "expenses to premiums" ignores the relative amounts of new and renewal premiums and the expenses applicable to each. If the comparison divides the expenses and also the premiums into "first year" and "renewal," the ratios are equally misleading, for the method in which each company spreads its acquisition expenses is not taken into account.

Ratios.

One very prevalent misuse of statistics is that of making comparisons between the ratios of actual to expected claims in two companies, as derived from the Gain and Loss Exhibit data. Such comparisons are misleading, of course, because the expected claims are not calculated by select tables.

Comparison of G. & L. Death Claims.

No two life companies are exactly alike; they differ in distribution of business, in premium rates, in methods of paying for new business, in the method of valuing assets, and in nearly every other respect. Analyze your own company's figures to your heart's content, analyze those of any other companies you choose. If you must make comparisons, compare the figures of your own company covering different periods, or do the same for other companies, but

Comparing Two Life Companies.

be sure that you are comparing figures which are comparable. When you compare the figures of any two companies, you are generally laying yourself open to the charge of making improper comparisons.

In connection with Disability Benefits, it is well to point out that a high rate of disablement at young ages is generally followed by a high death rate, so that, at disablement, the value of the benefit to the insured, and the liability of the company, should not be measured by the rate of disablement. In other words, it would be fallacious to measure the risk run solely by the rate of disablement.

Disability Benefits.

In a certain sense we may include among fallacies the representation of facts by methods which are sometimes misleading.

Graphic Representation of Data.

In using diagrams to represent various numerical data, advantage is taken of the ability of the eye to see quickly, but we constantly meet graphical fallacies due to the adoption of an improper method for representing the facts.

For instance, the relative strengths of the armies of the various powers engaged in the late war were sometimes depicted by soldiers of various heights. As a rule, the heights alone were in proportion to the numbers of the land forces intended to be represented in the pictures, whereas what we saw were areas bounded by the outlines of the soldiers. In the same way, the navies were sometimes represented by outlines of battleships, and here again the lengths and not the areas were in proportion to the tonnage or to whatever other basis was used in the comparison.

Circles, squares, rectangles, and all sorts of figures are constantly used to represent numerical data, and as often as not such diagrams misrepresent or fail to give the information intended to be conveyed thereby. Who can tell, for example, the relative areas of two circles by simply looking at them?

On the other hand, rectangular figures, with equal bases, while lacking the pictorial element, generally convey the relative magnitude of the numerical data which they represent. Again, curves and broken lines drawn on cross-ruled paper are well adapted for showing death rates by ages, amounts of insurance issued by ages, and other similar data which we often find it useful to represent graphically in our profession.

Of course, the object of my remarks has been to point out errors which would not have been made if those responsible for them had been properly educated in mathematics and had used their analytical powers thus acquired. It is of little benefit to acquire knowledge if we do not apply it properly, and the task of education is not so much to impart information as to train people to use their minds in ways that are helpful to themselves and to their fellowmen.

Comparison of Study of History and Mathematics.

Some studies are principally effective in cultivating the memory, whereas others develop the reasoning powers, both of which faculties are, of course, very necessary factors in a man's make-up. With a good memory a student can learn history or become proficient in languages, but if he lacks the power of reasoning he will never proceed far in mathematics.

In history we rely on written and oral testimony, and it is very difficult, if not impossible, in many cases to *prove* that what we have read and learned is correct.

On the contrary, in mathematics we do not take other people's say-so, nor do we rely upon authority merely, but insist upon every assertion being verified and upon every proposition being demonstrated before we consider it deserving of a place in our mathematical storehouse.

Mathematics.

Benjamin Peirce, one of our greatest mathematician-logicians, described mathematics some 50 years ago as the science which draws necessary conclusions—a definition which places emphasis on the *method* rather than on the *subject matter* of mathematics. Bertrand Russell, the English mathematician, defined mathematics twenty years ago as the science concerned with the logical deduction of consequences from the general premises of all reasoning—a definition which adds the notion of truth to Peirce's definition and puts mathematics in very close touch with logic.

Our Society's Curriculum.

If we take the mathematical subjects covered by our Society's syllabus of examinations, the usefulness of our mathematical studies will be at once apparent to us.

Commencing with arithmetic, the necessary foundation for the subsequent study of mathematics, we find that the essentials for acquiring the knowledge of arithmetic are: concentration of thought, patient attention to detail, and accuracy and care in numerical computation. Even in this first mathematical subject one is being introduced to scientific classification and nomenclature and has to learn the rudiments of logical reasoning, consisting so far almost exclusively of applications of inductive logic.

Arithmetic.

Whether we define this as "generalized" arithmetic, or "universal," or, perhaps, "shorthand" arithmetic, we recognize in the second subject of our curriculum a generalization of arithmetic where the special problems and the particular results are made universal through the means of general symbols and of that specifically algebraic instrument—*the equation*. The concise algebraic notation, of which our actuarial notation is an excellent example, enables us, at a glance, to grasp and visualize, exactly and without ambiguity, a whole series of complex operations. Here, too, we make our first acquaintance with the concept of a "function" which proves so important in our future studies.

Algebra.

Although geometry is one of the most ancient subjects, we to this day learn its principles from the divine "Elements" of Euclid, dressed in a more or less modern guise. This chain of closely connected links of theorems deduced from a few axioms and postulates forms one of the finest specimens of deductive logic achieved by human genius. After one has mastered his Euclid, even if the chain of the theorems is subsequently broken and some of the links are lost, the acquired habit of logical reasoning continues to have its permanent effect throughout life.

Geometry.

Passing over trigonometry, which is but a detailed study of a chapter in geometry, dealing particularly with the triangle, we come to analytical geometry—the result of the method, invented by Descartes, of applying algebraic analysis to the study of geometric figures. Some of us are more apt at algebra, others at geometry; in the study of analytical geometry, the two faculties of mind, of successfully dealing, one in numbers and the other in images, are both called into play. Again, the "graph" or the geometric representation of

Analytical Geometry.

a function, which is utilized so extensively in the calculus and in statistics, receives here its first systematic treatment.

In all the preceding subjects the student has dealt with finite quantities and with finite changes in those quantities. But commencing with calculus, he is introduced into the realm of the infinite—the infinitely *great* as well as the infinitely *small*—principally, however, the latter. The new subject matter, the work of the two immortals, Leibnitz and Newton, is rather difficult for the beginner. However, after assiduous and concentrated study he succeeds in grasping the new concepts and symbols, the infinitesimal and the differential, the processes of differentiation and integration, the theory of maxima and minima, and then, the scholar may congratulate himself upon possessing some kind of Aladdin's lamp, as in the calculus he has acquired a tool which enables him to overcome difficulties otherwise insuperable and to solve problems which could not be solved without it.

Differential and Integral Calculus.

While the refinements of actuarial science require the infinitesimal calculus, we may justly say that for our every-day work the more important subject is the calculus of finite differences. The calculations of the thousand and one kinds of premiums and reserves in the actuary's career are made possible only through the application of the interpolation and summation formulæ developed in the latter calculus.

Calculus of Finite Differences.

And last but not least, let us not forget the subject which to our profession is just as indispensable as the sewing needle to the tailor and the magnetic needle to the sailor, the subject which underlies the business of life insurance and the profession of actuary—the theory of probabilities. Even with a good knowledge of algebra, this theory is not easy; the path leading to it is in many spots ragged, and some of the hills are hard to climb; but having once mastered the principles, we find its application in our practice so frequent and so manifold that no efforts can be considered too great for learning it in the most thorough manner.

Theory of Probabilities.

Even at the risk of repeating myself, I wish to expand a little more on the close relationship between mathematics and logic. Like logic, mathematical science is sometimes deductive, sometimes inductive; deductive when we pass from general principles to particular conclusions, and inductive when we pass from particular data to underlying general principles.

Mathematics and Logic.

In pure mathematics we principally employ the deductive method, while in applied mathematics, as physical sciences, we recur mostly to the inductive method. Our actuarial science is, on the one hand, a particular branch of pure mathematics, when we deal with the mathematical theory of the subject; and, on the other hand, when we are concerned with the applications to life contingencies, as, for instance, in our observations of mortality, it is but a physical science, and therefore a branch of applied mathematics.

Thus, geometry is probably the best example of the part of mathematics developed by *deductive* logic; while Newton's theory of the universal law of gravitation, formulated 250 years ago, and its modification in Einstein's theory of relativity, a couple of years ago, or, again, Makeham's formula expressive of the law of mortality, published some 60 years ago—are all examples of the results of the *inductive* process. The same inductive principles are followed by us in drawing up and graduating a mortality table from collected numerical data of "existing" and "died."

I have altogether failed in my object if it is not evident from what I have said that the mathematical training gradually develops in us the habit of mind which requires strict proof to be furnished of every proposition even if it seems at first self-evident.

Advantages of Mathematical Training.

On the other hand, the illustrations of the various fallacies which I have given tend to prove that too few people now-a-days take the trouble to ascertain their facts before reaching their conclusions. Apparently they think it better to come to a conclusion "right off" than to come to a "right" conclusion. There is a general lack of proper investigation of statistical data in a scientific manner, of proper analysis of such data, and of drawing proper logical conclusions therefrom.

Proper use of Vital Statistics.

By way of contrast, let me cite an example of a situation where our actuarial training can be put to good use outside of our own immediate business, and there are certainly many occasions where the analytical training of the actuary can be utilized to the great advantage of the community in which he lives.

This is an actual occurrence: A certain manufacturing town had been in a flourishing condition for several decades; the decennial census returns showed that the population had been increasing more or less regularly, through excess of births and immigration over deaths and emigration. The local school board had been building a number of new schools every few years and the increased accommodation of these schools had met the increased demand therefor. Then business suffered a severe depression; many men left the local shipyards and sugar-refineries for work elsewhere, and the population ceased to increase at its old rate. The chairman of the school board was something of a statistician, and he appealed to an actuary for help. Together they obtained data from the shipyards and the refineries, and from the registrar of births, deaths and marriages. By making use of these, the actuary estimated the number of children of school age for the next few years, and from these estimates showed that no further building of schools would be necessary in the immediate future. The chairman convinced the school board of this; no schools were built, and time proved that, had they been, there would not have been sufficient children to fill them.

Had it not been for the chairman's imagination, his habit of dealing with statistics, and his wisdom in consulting an actuary, it is probable that that town would have expended, within the next few years, a considerable sum of money in building useless new schools.

Conclusion.

The greatest problems of the day are the political, social and economic readjustments of the world after the war, and one of the obstacles standing in the way of these readjustments is the lack of clear thinking which is now so evident. Especially when this failing has to do with statistical data, our training as actuaries qualifies us to check up the conclusions, to point out the fallacies, and to correct the errors.

The aim of our Society and of its members should be to seek the truth even if it leads to disappointment, and to present results of investigations without bias or prejudice; "to substitute facts for appearances and demonstrations for impressions," as our Society's motto has it.

The field of activities of the actuary has, as a rule, been limited to life companies, casualty and accident companies, pension funds,

and similar institutions. But there is a much broader field into which we hope he may some day gain an entrance. Statistics are drawn up in nearly every institution in the land—political, social, religious, financial, and so forth. They broadcast—through bulletins, the daily press, magazines, and otherwise—data, and comparisons of all sorts and conditions; if the information covered be correct, well and good; but, if it be not, the misrepresentation has started on its nefarious journey, and there is no saying what damage it may do in misleading the unwary, and for that matter, the wary, for we are all too prone to believe what we read, and have seldom time or opportunity to verify or confute these statements.

In many of these institutions and in many publishing houses, there is certainly great need for a trained actuary—one who can analyze the data and can see to it that the conclusions drawn from them are logical. Who can say that this will not be one of the fields open to the actuary in the future?

Our Society.

My term as President of the Society is about to end, and I cannot let this opportunity pass without thanking you for the great honor which you have bestowed upon me. I am more than sensible of my failings, and if the Society has accomplished anything of value during these last two years it is due to the impetus given it by the excellent work of my predecessors and to the suggestions and help which the officers, council, committees and members have at all times rendered.

Two noteworthy changes have taken place in our meetings during my presidency. The first is the plan proposed by my predecessor, of discussing papers at the meeting at which they were presented, and the second is the "Informal Discussion of Topics of Interest" in lieu of the previous "Question Box." Regarding the first, we are fortunate in having a number of papers to discuss at this meeting, but, unfortunately for the proper working of this plan, the galley proofs reached us very late. It is true that the unpreventable delay in our printer's office contributed to this condition; but this was aggravated by the fact that some of the papers were sent in at a late date.

To avoid a recurrence of this condition, I wish to impress upon

you all the necessity of preparing and submitting papers in the future at as early a date as possible.

As you know, a committee of the council was appointed, more than a year ago, to investigate the subjects covered by our examinations, and they suggested a limitation of the program for Parts I and II of the Associateship examinations. These changes became effective in the examinations of last year and have met with the approval of our members. No further changes are contemplated at present.

Our Society continues to grow, and it looks as if it may be necessary in the near future to extend our meetings to cover Friday afternoon. The growth of our membership has been accompanied by an increase in the size of our printed *Transactions*. During the first half of the Society's existence, the Secretary was also the Editor of its *Transactions*, and each volume covered two years' proceedings. Time came when it was necessary to have a separate Editor; then it was found necessary to have a separate volume for each year's proceedings. The work of the Editor has now increased to such an extent that at a recent meeting of the Council it was decided to give future Presidents power to appoint one or more assistants to the Editor. These assistants will not automatically, under our by-laws, be members of the Council; their duties are intended to be such as the Editor may direct.

Mr. Craig's Death.

It is my sad duty to report the death, since our last meeting, of our beloved ex-President, James McIntosh Craig. He was so full of the joy of life, so bubbling over with humor, so overflowing with human kindness, so charged with energy, that, until we met him in business, we were little likely to think of him as being one of our charter members or as having served his company for over half a century. But, let us discuss business with him, and the experience and mellowness of judgment which come only with years became at once apparent. We shall miss him sadly in our gatherings for his joy and for his judgment.

Mr. Gore has prepared a minute regarding Mr. Craig, which, in Mr. Gore's absence, I shall now read, but I cannot let this opportunity pass without adding my humble tribute to the memory of our dear friend.

James McIntosh Craig.

The Actuarial Society has lost another of its charter members and the loss is indeed a great one. James McIntosh Craig will be seen no more among us.

Mr. Craig was born in Philadelphia of Scotch parentage in the year 1848. In his boyhood days he developed a fondness for mathematics and early became interested in actuarial science. For the remarkable period of fifty years as actuary of the Metropolitan, he served his company faithfully and brilliantly. He was the author of a number of important actuarial papers, and his thoughtful, clearcut comments on papers presented by members of this Society were especially valuable. Under his supervision was prepared the Industrial mortality table, based upon his company's experience, which was later made the Standard Industrial Table of the State of New York. Always active and helpful in the councils of the Society, Mr. Craig was made its President in the year 1914, serving for two years.

An eminent actuary, a deep thinker, a keen debater, a vigorous but fair fighter, a genial companion, a warm friend, he was admired and loved by all who knew him.

Income Taxes Imposed upon Life Insurance Companies by the Revenue Act of 1921.

BY

E. E. RHODES.

The provisions of the Revenue Act of 1921 affecting life insurance companies are particularly noteworthy in two respects. They mark the recognition by Congress of the business of life insurance as a peculiar business differing from that of all ordinary commercial institutions to such an extent as to require special treatment. They also represent the successful results of coöperation between the Government and the life insurance companies, both parties having no other desire than that of formulating a reasonable and consistent plan of taxation. The new plan does not violate the technical requirements of the business, while the practical advantages to the Government and to the companies alike are exceedingly important. Both can count with reasonable assurance upon the amount of tax to be paid. Certainty has been substituted for uncertainty, equality for inequality and simplicity for confusion. Moreover, the tax is ascertained and collected at a minimum of expense.

A student of taxation who is not concerned with the requirements of legislation may find a number of opportunities to criticize the new plan. The practical man who is aware of the viewpoint of the Government, confronted as it is with the necessity of raising an abnormal amount of revenue, and the widely differing conditions found in the large number of life insurance companies transacting business in the United States, may well wonder at the fact that it was possible for the Government and the companies to agree upon a plan which conforms so closely to the plan which the student would have prepared.

In considering the subject it must be remembered that the new plan is a substitute for the old income tax, the war-excess-profits tax, the capital stock tax and the tax on the issuance of policies. These various taxes affected the several companies in different

ways. One class of companies found a particular tax very embarrassing. Another class of companies did not feel the ill effects of that particular tax, but was embarrassed by one or more of the other taxes. In the work of finding a single substitute for these several taxes upon which all could agree compromises were therefore necessary. Considering all the compromises that were made it may be noted that on the whole they favored the younger and smaller companies. The large companies will pay a higher percentage of the aggregate tax than they have paid under the existing law.

When the Revenue Act of 1918 was under consideration by Congress the new plan was presented to the Senate Committee on Finance by the representatives of the Treasury Department. It found favor with the Committee, which in its report of December 6, 1918, said:

"A new basis is recommended for the taxation of life insurance companies. The tax is in form an income tax, but is imposed upon a net income defined with special reference to the peculiar conditions of the business of life insurance. Roughly, it consists of the gross income from interest, dividends, and rents less tax-free interest, investment expenses, and taxes and other expenses paid exclusively in connection with real estate owned by the company. In the case of a domestic life insurance company there is also a specific deduction of $2,000. Thus the tax falls upon the true income of the company, that is, its income from investments; and the rate is so fixed that this tax takes the place of the income tax, war-excess-profits tax, capital stock tax, and the tax on the issuance of policies. It will yield considerably more revenue than the taxes which it is designed to replace, and has the great merit of simplicity and certainty. Above all, it avoids the almost insuperable difficulty of defining the invested capital of a life insurance company for purposes of the war-excess-profits tax."

The new plan was adopted by the Senate, but it did not meet the approval of a majority of the Representatives of the House in the Conference Committee, and it was not therefore enacted. It appeared in the present Act when the bill was introduced in the House, and met with instant favor in both the House and the Senate.

The following summary comparison reveals at a glance the differences between former income tax laws and the new law:

FORMER INCOME TAX LAWS	NEW LAW
GROSS INCOME	
Interest, Dividends and Rents	
Included	Included
Premiums	
Included	Eliminated
Profit on Sales of Assets	
Included	Eliminated
DEDUCTIONS FROM GROSS INCOME	
Tax Exempt Interest	
Included	Included
Net Addition to Reserve Fund	
Included	Limited to excess of 4% of mean reserve over tax exempt interest and to 2% of deferred dividend fund.
Dividends from Other Corporations	
Included	Included
Investment Expenses	
Included	Included (to a limited extent if there be any allocation of general expenses)
Real Estate Taxes and Expenses and Depreciation	
Included	Included (with special provisions regarding home office properties)
Interest Paid on Indebtedness	
Included	Included
Insurance Expenses	
Included	Eliminated
General Taxes	
Included	Eliminated
Loss on Sales of Assets	
Included	Eliminated

It will be seen that, as stated by the Senate Committee on Finance, the tax is imposed upon the net income from investments. Strictly speaking a life insurance company, particularly a mutual company, has no other income. I am not unmindful of the fact that in the annual statements of life insurance companies premiums appear as income, but this is purely a matter of convenience. A life insurance company is a corporation the members of which, generally speaking, are those insured in and with the corporation. The policies held by them are the evidence of their membership and of their interest in the corporation. The cash which they pay therefor is as much actual cash capital paid in as the cash paid into an ordinary stock corporation by the members thereof for their certificates of stock. There is a dual relationship between the member of the insurance company and the company in that he is a member of the corporation and also the holder of a contract with it. What he pays into the corporation he pays under his contract. He enters into the contract for the purpose of becoming a member, and the contract is necessary if he is to be a member. This situation is fundamental. A local building and loan association deals only with its own members, but no one would deny that the cash paid in by the members was a part of the association's capital. While the premiums paid under a contract of life insurance are the consideration for the contract, it does not follow that such premiums constitute income. The premiums are really the capital contributions of the associated policyholders of a life insurance company for the purpose of carrying on their joint venture. Such capital contributions are augmented by the interest earnings thereon and it is such interest earnings which make the venture successful.

We may now proceed to a discussion of the various provisions of the new law. It may be noted first that profit on sales of assets is eliminated from gross income, and that any loss on sales of assets is eliminated from the deductions from gross income. To my mind this is a change from the old law which might well be applied to all businesses. Perhaps no one feature of the income-tax law in its application to business generally has involved more injustice and has been provocative of more litigation than the question of determining the taxable profit arising from the sales of capital assets. On the other hand no provision has afforded as great an opportunity for the evasion of taxes as that

allowing a deduction by reason of the loss sustained on sales of capital assets. The exclusion of these items would greatly simplify the returns, and in my opinion would work no real hardship to the taxpayers, nor it seems, would their exclusion affect the total amount of tax derived by the Government. What is one man's loss is another man's gain and vice versa.

One of the most noticeable things regarding the new law is that from the standpoint of the companies there is no advantage to be gained in holding tax-exempt securities the interest on which is less than 4 per cent. of the reserve. It has been suggested that with respect thereto the law is unconstitutional in that Congress has done indirectly what it could not have done directly. Whether Congress is under any constitutional requirement to exempt from income-tax interest upon the obligations of the several states and subdivisions thereof is an unsettled question and one which need not be here discussed. In the new income-tax law as well as in all previous acts such income is not taxed. In this respect life insurance companies are treated as all other taxpayers are treated and the constitutional limitation, assuming such to exist, is not impaired. It was within the power of Congress to tax the gross interest income of life insurance companies and allow no deductions whatever, except possibly for tax-exempt interest. Congress however did allow certain deductions to life insurance companies differing in some respects from those allowed other corporations. These deductions as well as those allowed other taxpayers are a concession to the taxpayers which the courts will not enlarge beyond the clear terms thereof. Congress is not required to treat all taxpayers alike. The requirements of uniformity are met by the application of a general rule to a particular class. Among the deductions allowed life insurance companies is the sum of any excess of 4 per cent. of the mean policy reserves over the amount of tax-exempt interest. If in allowing this deduction Congress has exercised any discrimination it is in favor of the companies and not against them. As between different companies there is no discrimination. Every company will deduct its tax-exempt interest whether it be more or less than 4 per cent. of the reserve. If it be less it will also deduct the difference between 4 per cent. of the mean policy reserve and the amount of tax-exempt interest. Congress is not concerned with whether or not one life insurance company holds proportionately a larger amount of tax-exempt

securities than another. If that is the case one company will have a larger deduction by reason of tax-exempt interest and a smaller deduction by way of the excess of 4 per cent. of the policy reserve than another. Neither company is injured. A particular company may have invested largely in tax-exempt securities with the expectation that its future taxes would be thereby decreased. If it is disappointed therein it has no redress. Taking the two provisions together, it may be said that Congress has granted all companies alike a minimum deduction of 4 per cent. of the reserve. If the tax-exempt interest amounts to more than that sum, it is all allowed as a deduction.

No one will contend that Congress is under any obligation to make state or municipal bonds attractive to life insurance companies as investments by reason of any advantage to be gained under the Income Tax Law in holding them. Congress may be required to respect, but is not required to extend, the borrowing privileges of states and political sub-divisions thereof. No one would suggest that in order to make such bonds attractive the interest rate might be increased, say, 1 per cent. and that the United States should pay the difference. The effect, however, would be the same as if Congress by some other method made it to the interest of taxpayers to invest in such bonds. Whether taxpayers realize a larger net return upon such securities than upon others is a matter which does not concern Congress.

The question that will arise most frequently in connection with the new law will be with regard to the deduction on account of the policy reserve. Why was not the actual rate required to maintain the reserve used instead of 4 per cent.? The answer has to do with one of those compromises to which I have referred. When the law was first proposed the intention was to use the actual rate required to maintain the reserve, but at that time the new law was to be only a substitute for the then existing income and excess profits taxes. To secure the assent of a number of companies it was necessary to make the new tax a substitute also for the existing tax on the issuance of policies and for the existing capital stock tax. The tax on the issuance of policies operated especially to the detriment of the younger and smaller companies. It took a much larger toll of the income of such companies than it did of the older and larger companies. The burden was laid upon new policyholders and the greatest sufferers were those insured under

the cheaper plans. The larger companies whose new business is a comparatively small percentage of their outstanding business did not feel the tax particularly. On the other hand, the large companies were maintaining their reserves upon a lower rate of interest than the small companies. The large companies were willing to assume a large share of the burden of the new tax, but it was recognized as fair that if the smaller companies were relieved of the burden of the tax on the issuance of policies, the larger companies should be granted some offset. Hence the adoption of the 4 per cent. deduction on account of the reserve. The compromise was decidedly to the advantage of the smaller companies. Furthermore, the uniform rate was desirable in that it facilitated the auditing of the returns. The Internal Revenue Department had no means of determining the correctness of a company's calculation of the actual interest required to maintain the reserve.

The deduction of 2 per cent. of the deferred dividend fund was another compromise. The companies holding such funds thought that they were fairly entitled to a deduction of 4 per cent. in order to put them on a parity with other companies, but they consented to a deduction of 2 per cent.

There are certain investment expenses which cannot be determined with exactitude. Among these are the salaries of officers whose time is devoted partly to the investment side of the business and partly to the insurance side. There are other expenses such as heat, light and rent, some portion of which is properly chargeable against investment expenses. If a company makes any such allocation the expenses allowable as a deduction, aside from real estate taxes, expenses and depreciation, are limited to a sum not exceeding $\frac{1}{4}$ of 1 per cent. of the mean invested assets. This rule for computing general investment expenses is found in Section 97 of the Insurance Law of the State of New York (Chapter 28 of the Consolidated Laws). This law was first enacted in 1906 and has worked well in practice. The rule is sufficiently strict to prevent any company from unduly overstating its general investment expenses if it makes the allocation referred to above. There are a few companies however which without any allocation can show actual investment expenses in excess of $\frac{1}{4}$ of 1 per cent. of the mean invested assets. These companies invest their funds principally in real estate loans. They have salaried representatives in the field whose duties are to procure such loans and to inspect the

mortgaged properties. These companies receive on their mortgage loans a higher rate of interest than is generally received by companies which procure their loans from individual sources. The gross income of the former companies would therefore be proportionately larger than the gross income of the latter companies, and there would be an unjust discrimination against the former if they were not allowed to deduct their actual investment expenses. The law accordingly provides that a company may deduct its actual investment expenses if it does not include in the deduction any portion of salaries, etc., paid partly for investment purposes and partly for other purposes.

There is a question whether taxes and expenses paid and depreciation charged off by a company upon its home office building should be allowed as a deduction. Companies which do not own their home offices have to pay rent for the quarters which they occupy and such rent is not an allowable deduction from gross income under the principle upon which the law is based. In the case of a company which owns and entirely occupies its home office building the taxes and expenses thereon are in lieu of the rent which it would otherwise pay. Therefore such taxes and expenses should not be allowed as a deduction. There are however companies which do not occupy all their buildings, and those companies have to include in their gross income the rents received from other tenants. Whether such companies will secure any deduction on account of taxes, expenses and depreciation will depend generally upon the extent to which they rent space. If the rents received from other tenants together with the reasonable rental value of the space occupied by the company would give the building a net earning value of 4 per cent. of the book value at the end of the taxable year, the company is given the benefit of the deductions. Four per cent. was used because that is the deduction allowed on the reserve. The practical result is that if a company rents the major part of its building to other tenants the building is properly regarded as an investment, and the company will get the benefit of the deductions. On the other hand if a company occupies the major part of its home office building so that the amount of rental received from other tenants is only incidental, it will not get the benefit of the deductions, although it will have to include in its gross income whatever rent it receives from other tenants. It will not be required, however, to include in gross in-

come the rental value of the space which it occupies. Each building owned and occupied in whole or in part by a company may be treated separately. The above is a good practicable working rule. It might have been refined by providing that a company might deduct such a proportion of the taxes, expenses and depreciation as the rents received from other tenants bore to the entire rental value, but such a provision would have involved administrative difficulties.

Foreign life insurance companies will ascertain their net income in the same way as insurance companies domiciled within the United States, except that they are not entitled to the specific deduction of $2,000 allowed under paragraph (9) of Section 245 (*a*). The taxable net income of a foreign company is the same proportion of its net income arising from sources within and without the United States which the reserve funds required by law to be held at the end of the taxable year upon business transacted within the United States are of the reserve funds held at the end of the taxable year upon all business issued.

Discussion of Preceding Paper.

(written discussion.)

MR. E. M. BLEHL:

The paper which has been read points out the improvement in the income tax law, relating particularly to the clearer delineation of the items to be taxed. The changes, however, have reduced taxes for some companies and increased them for others, so that they are not entirely satisfactory to all companies.

The law exempts from taxation interest received on governmental obligations, federal, state and municipal. The section needs to be considered in conjunction with the item permitting credit to be taken for four per centum interest on reserve funds, wherein it is provided that if exemption is taken for interest received from governmental obligations, then a corresponding amount of interest on reserve funds is not allowed. The device seems to constitute an evasion of the understanding under which war time bonds were purchased, when it was stated that certain tax exemptions would be allowed thereon. As the arrangement now stands, however, there is no difference in tax assessed against a company

having a large percentage of its funds invested in governmental securities and a company having none. Also in view of the fact that other concerns obtain this exemption, without a corresponding decrease of exemptions elsewhere, the rule with regard to insurance companies seems to partake of the nature of discrimination. The law says that an exemption of interest on reserve funds will be allowed, unless a company holds governmental obligations, in which event the amount equivalent to the interest earned thereon shall be deducted from the interest on reserve funds. Does not the law, therefore, impose a penalty on a company which holds governmental securities?

The regulations state that, generally speaking, items 7, 8, 9, 10 and 11, of the liability page of the annual statement, will be considered as reserves as contemplated by the law.

Further, deduction is allowed for "All interest paid or accrued within the taxable year on its indebtedness, except on indebtedness incurred or continued to purchase or carry obligations or securities (other than obligations of the United States issued after September 24, 1917, and originally subscribed for by the taxpayer), the interest upon which is wholly exempt from taxation under this item."

It would seem, therefore, that the following items should be included in reserve funds:

Due and unpaid on supplementary contracts not involving life contingencies.

Dividends left with the company to accumulate at interest and accrued interest thereon.

Premiums paid in advance including surrender values so applied.

Borrowed money and interest thereon.

These items constitute either reserve funds or items of indebtedness. Inasmuch as a question might be raised with regard to the rate of interest earned thereon, it would seem that these items would be classed as reserve funds, no credit, however, being taken for any portion of these items on which interest is not paid nor discount allowed.

The regulations provide that the deduction allowed for interest on indebtedness is the same as that allowed to corporations, but on dividends and interest thereon held on deposit surrendered during the year only the interest element actually paid is allowed. The law specifies interest "paid" or "accrued" on its indebtedness, but the regulations limit the deductions to interest "paid."

(ORAL DISCUSSION.)

MR. D. H. ROSE:

I want to ask a question. Under the law these tax-exempt securities no longer give any special advantage, and I would like

to know whether the effect has been, especially with the larger companies that have large funds to invest, to stop them from investing in securities of that description. If they have stopped investing in securities of that description, it does not seem to have had any particular effect upon market values, although they are considerable investors ordinarily, because the values of such securities as well as of other kinds have steadily gone up. I am interested to know if anyone here can tell definitely whether the larger companies especially have ceased buying municipal and government securities.

MR. W. H. HUTCHESON:

I think it has had that effect, Mr. Rose. I know of several companies that have discontinued.

(AUTHOR'S REVIEW OF DISCUSSION.)

MR. E. E. RHODES:

The correctness of Mr. Blehl's statement that the new law reduces taxes for some companies and increases them for others depends very largely upon one's point of view. In connection with the old laws there are a number of controversial questions between the Bureau of Internal Revenue and the companies which remain unsettled. With regard to the tax which the new law will yield, I regard it as a compromise between the claims of the Bureau and the claims of the companies. The principal aim of those who cooperated in drafting the new law was to secure a scientific method of taxation in place of the unscientific and heterogeneous methods found in the old laws. They thought that this was of more real value to the companies than a reduction in taxes.

I think that Mr. Blehl's remarks concerning the deductions for tax-exempt interest and reserves are fully answered in the original paper.

Life Reinsurance.

BY

W. N. BAGLEY AND J. M. LAIRD.

I. Development.

A life insurance company frequently receives application for more insurance on one life than it feels justified in retaining at its own risk. For the purpose of encouraging the agent and increasing its prestige with the public, it may wish to issue the entire amount requested. Such issue is made possible through protection of the excess liability by means of reinsurance in one or more other companies.

Although the desire for reinsurance was felt in this country more than half a century ago, the occasions were at first comparatively few and the coverage difficult to obtain because officials feared an adverse selection and a heavy mortality on policies then looked upon as large. Consequently a company accepted reinsurance reluctantly if at all and only in consideration of similar assistance for its own surplus risks, obtained under a reciprocal arrangement.

Gradually, however, with accumulating experience, improved methods of selection and better knowledge of the business, the companies acquired greater confidence in themselves and in each other with the result that large policies were more freely issued and reinsurance facilities more easily secured.

In 1903 German companies entered the United States for the purpose of accepting reinsurance from American companies. They had no agency organization and confined their operations to reinsurance, but through connections with other European companies were able to accept individual reinsurance for large amounts. These German companies were obliged to cease writing new business in 1917 on account of the war, but they contributed notably to the development of life reinsurance in this country. Indeed they marked the first real advance because not only did they provide coverage corresponding with policies of the original companies but they made it possible for the companies to obtain reinsurance with-

out accepting any in return. Their place has been taken by new reinsurance companies organized in the United States and by well established American companies selling life insurance to the public through agency organizations but accepting reinsurance from other companies through reinsurance departments.

The great development in life reinsurance which has occurred during the last four years is due chiefly to the boom in all lines of life insurance and particularly in policies for large amounts. The increasing number and size of large risks may be attributed to several factors:

1. The growth of the life insurance idea;
2. The general prosperity of the country;
3. The popularity of corporation insurance;
4. The use of insurance to meet inheritance taxes.

A few companies of moderate size still refuse to issue more than they care to retain, apparently on account of either or both of the following reasons:

1. Fear that the company accepting reinsurance will in turn ask that its own excess lines be shared;
2. The feeling that reinsurance can be obtained only at rates which render the protection undesirable.

The first objection is being gradually cleared away by the fact that several reliable organizations are willing to accept reinsurance without requiring the other company to reciprocate. The second objection has been practically eliminated by competition and the corresponding liberalization of reinsurance contracts and practices.

Although during the readjustment period of 1921 there was a falling off in the issuance of large policies, it is probable that in normal times the demand for policies requiring reinsurance will continue to increase. It is fortunate therefore that satisfactory reinsurance facilities have been developed for distributing the excess line among well established American companies.

II. Legal Requirements.

Practically all states permit reinsurance but some have placed legal safeguards on the business. For instance, Connecticut does not permit a domestic company to reinsure in any one company an

amount greater than its own retention, and North Carolina does not permit a domestic company to reinsure in a company not licensed in that state. Several states, including New York, permit reinsurance in an unauthorized company, but do not allow the original company to take credit for reserve or amounts due on reinsurance obtained from an unauthorized company.

In the tax return of certain states reinsurance premiums may be deducted only if paid to a licensed company.

III. Reinsurance Principles.

Experience has shown that the most satisfactory results are obtained if the original company retains a substantial part of the risk for its own account and if the policy conditions and rules of the original company are followed by the reinsurer.

The original company should show as keen an interest in the protection of the reinsurer as in its own behalf and the reinsurer, in turn, should interpret the contract in a liberal spirit as a moral obligation to support the original company in every contingency.

The essential principle, in fact the one which contains all others, is that each company must have implicit faith in the integrity of the other.

IV. Mortality on Reinsurance.

1. *Policies for Large Amounts.* Investigations have shown that in general the mortality on policies for large amounts is greater than on policies of moderate size.

In the Specialized Mortality Investigation persons insured for $20,000 or more on one application showed a mortality of 108 per cent. of the standard.

In the American Men Experience the mortality on policies of $50,000 or more was 117 per cent. and on policies of $100,000 or over 131 per cent.

At the meeting of the Association of Life Insurance Medical Directors in January, 1919, Dr. Symonds, Medical Director of the Mutual Life Insurance Company of New York, indicated that usually the mortality on policies of large amounts is at least 10 per cent. greater than the normal. According to Dr. Symonds the excess lines of the Mutual Life reinsured in other companies under somewhat abnormal conditions showed an actual mortality of almost three times the expected.

Dr. Rogers, Medical Director of the New York Life, stated that in his company the mortality on large risks was from 120 per cent. to 130 per cent. of the Medico-Actuarial Table.

On the other hand, the experience of the Northwestern Mutual on large cases has been as good as its general average or even better, but Mr. Evans at the meeting of the American Institute of Actuaries in June, 1920, sounded the following note of warning: "These results fall far short of proving that the general tendency and particularly the speculative hazard of the present time can successfully be overcome by inspection and medical examination but even if as exceptional as a five-toed horse, the experience is encouraging to offices not sharing in the illusion that large policies have an advertising value that will justify lowering the standards of admission for their benefit."

Although a few companies may have had a favorable mortality on policies issued for their maximum amount, the committee in charge of the American Canadian Mortality Investigation, after reviewing all the evidence, reached the following conclusion: "It seems to be certain that the mortality on large risks taken at one time is higher than the average of the companies for risks of all amounts."

2. *Influence of Retention Limit.* Granted that the mortality on "large risks" is higher than the average, it still remains to define large risks. To a company with assets of $500,000,000 and maximum retention of $150,000 an application for $50,000 may be considered a normal risk. On the other hand, to a company with assets of $1,000,000 and maximum retention of $5,000 an application for $25,000 must be considered as relatively large. For reinsurance purposes, therefore, a large risk may be defined not as a policy in excess of $25,000, $50,000, or any other fixed figure but rather as a policy in excess of the company's limit of retention. Although definite statistics have not yet been published, it is generally understood that a company will experience the most favorable mortality on risks coming within its own retention and that a higher mortality will be experienced on amounts in excess of its own retention, that is, on the portion reinsured.

In fixing its limit of retention, the original company is governed by two considerations:

1. What is the maximum loss the company can reasonably sustain on one life?

2. What limit of retention will probably be most profitable for the company, that is, how high can the limit be set without retaining an undue share on large risks on which there will probably be an extra mortality?

The first consideration leads the original company to adopt a maximum of, say, $50,000 at age 35 on Life or Endowment policies but the second consideration may lead the company to retain only $20,000 at age 60 on Life or Endowment policies and to retain only $10,000 on Term policies issued at any age. In adopting a limit of retention graded by age at issue and plan of insurance, the company is in effect saying: "We feel that we can properly retain up to $50,000 on the best type of business, but we prefer to limit our liability to $20,000 or $10,000 on certain types, not because the company is unable to stand a loss of more than $20,000 or $10,000 but because we expect these types to show an unfavorable mortality experience."

This graded scale favors the original company and tends to place the unfavorable mortality on the reinsurer. Furthermore, if the original company later finds it is having a favorable experience on some form, for instance, Term insurance, it may forthwith increase its limit of retention on that form and thereby transfer the profitable business from the reinsurer to the original company.

It is, therefore, reasonable to expect that the mortality on reinsurance will be greater than on the original company's own retention. Also, it is usually considered that among policies reinsured the most favorable mortality will be experienced on the first excess or first surplus and that the worst mortality will be found on those sporadic risks for such large amounts as require reinsurance in several companies.

3. *Effect of Residence.* In the American Men Experience the mortality in a group of Middle Western states was 89 per cent. of the normal and in certain Southern states 124 per cent.

Although good business is undoubtedly obtained in certain sections of the South and conditions in the other sections may be improving, it is probable that reinsurance obtained from a company operating chiefly in the Southern states will show a higher mortality than reinsurance from a similar company operating chiefly in the Middle Western group.

4. *Conclusion.* Consequently it may be held on the one hand

that reinsurance premiums should take account of the original company's retention limit, the portion of surplus covered and the section of the country from which most of the business will come; or, on the other hand, that just as in the case of direct business, one schedule of premiums should be used for all standard risks.

V. Facultative Reinsurance.

When there is no obligation in either the offer or the acceptance of reinsurance, it is known as "Facultative."

Under this method if reinsurance is required for any case, it is customary to submit copies of all papers pertaining to the risk to such companies as may be chosen, each of which accepts, rates, or declines according to its own underwriting standards.

The advantage to the original company is twofold:

1. The coverage may be sought from whatever source desired;
2. The benefit of additional and independent underwriting is obtained.

The opinion of a larger and more experienced underwriting department, particularly with regard to borderline and substandard risks, if the reasons leading to the opinion are recited in some detail, can be of invaluable help to the original company and may frequently save it from an undesirable risk which otherwise would have been accepted.

One objection is the uncertainty as to how much reinsurance can be secured and therefore how large an application the agent is justified in submitting to his own company.

A more serious objection is the delay in securing the reinsurance coverage necessary before the original policy can be delivered. This delay is greatest when the reinsurer is located at a considerable distance from the original company but even under the most favorable conditions when the reinsurer acts promptly on each case and indicates its decision by telegram or telephone, there is sure to be an interval of a few hours or even days between the time the original company receives its completed papers and the time it knows that the reinsurance has been approved.

From the standpoint of the reinsurer the method is desirable because the company is free to apply its own underwriting rules and

it need not accept reinsurance even on a first class risk if it has already issued its full limit on that particular life.

A facultative arrangement operated reciprocally among companies with Home Offices located comparatively near each other meets most requirements if the underwriting practices of the companies closely agree but if the rules of any one of them are markedly at variance with those of the others, a feeling of irritation may readily develop. Moreover, if the companies operate in the same territory, there will occasionally be an overlapping of risks. If one company has issued a large policy on a given life and has secured the maximum reinsurance from each of the other companies, the others are thereafter debarred from issuing a policy on the same life through their own agency forces unless further reinsurance outlets are open.

The reciprocal facultative method was followed for many years because there were no other means for securing reinsurance. However, the idea has found continued application and in some instances has been expanded to take in as many as five or ten companies. An advantage is that if there is any profit on the business reinsured, this profit is divided among the originating companies but by the same token it follows that if the business proves unprofitable, then the loss must likewise fall on these original companies.

VI. Automatic Reinsurance.

When there is obligation on the part of the original company to cede and on the part of the reinsurer to accept the reinsurance, it is known as "Automatic" or "Obligatory."

By such a treaty the original company is bound to cede to the reinsurer all amounts in excess of its own retention, but not exceeding a certain proportion, usually 100 per cent. of such retention, and not exceeding some fixed limit, such as $10,000, $25,000, or $50,000. Occasionally automatic coverage can be obtained from a larger company for more than the retention, or arrangements may be made with two reinsurers, in which case the first excess may be ceded to one and the second excess to the other, or the excess may be divided equally between the two with the proviso that the amount ceded to either shall not exceed the retention limit of the original company.

The reinsurer must accept the reinsurance ceded even though it may have already issued its full limit or may consider that the

risk does not meet its own underwriting standards. The underwriting of the original company governs absolutely and must be accepted without question by the reinsurer. For this reason it must be expected that a given automatic arrangement will not prove desirable to the reinsurer if the underwriting views are decidedly different in important respects.

This method usually covers only risks accepted by the original company as standard, but it may be extended also to those accepted as substandard on account of occupation, overweight, family history, or physical impairment.

In some treaties the coverage is automatic with the one exception that the original company cannot bind the reinsurer if the latter already has its limit in force. As this information can readily be given by telegram, this plan does not delay the issuance of the policies and occasionally it warns the original company of contemplated overinsurance not disclosed by its own papers.

At one time there were in operation so-called automatic treaties but they really were only partly so, inasmuch as the obligation was on the part of the reinsurer alone, the original company being free to cede at will within certain limits.

Usually the agreement stipulates that the original company shall not have the right to bind the reinsurer for more than 100 per cent., or at the most 200 per cent., of the amount by which the original company is increasing its own retention on that particular risk. Therefore, if the original company already has issued its full limit and later receives an application for an additional amount, the reinsurance must be submitted on the facultative basis. If the reinsurer rejects a large proportion of these facultative cases, the original company may have cause for dissatisfaction, but if the reinsurer underwrites them on a liberal basis, the entire treaty should prove most satisfactory.

If a risk comes within the automatic provisions of the treaty, then the underwriting judgment of the original company is supreme and must be accepted by the reinsurer. Frequently however in the case of a borderline risk, the original company voluntarily submits the case on a facultative basis, partly because it prefers not to enforce the automatic provision in cases which the reinsurer might consider doubtful and partly because it may like to have the benefit of the reinsurer's underwriting to supplement its own opinion.

If a case is ceded as automatic and the reinsurer has information

which shows that the risk is unfavorable, the reinsurer must assume its share of the obligation. Presumably it will promptly notify the original company of the unfavorable features and if the original policy has not been placed, this action may save both companies from an undesirable risk. Even under an automatic treaty both companies may therefore gain by an exchange of information and of underwriting views.

To the original company the great advantage of automatic reinsurance is that it is able to issue at once upon its own approval policies for two, three, or four times its own retention limit. In this way it is able to give quick service to its field force even though the reinsurance may be placed in a distant company. The automatic treaty is particularly valuable to the original company if the applicant applies simultaneously to several companies.

Automatic reinsurance was introduced in this country in 1903 and has met with increasing approval. It has been applied in as many as ten treaties in order to handle the surplus lines of a single company and more recently has been placed in reciprocal operation for a group of companies.

VII. Plans of Reinsurance.

Whether facultative or automatic, the reinsurance may be written according to one of the following five plans. The first three of these plans are still receiving application, but most of the reinsurance written today in this country is by the "Coinsurance" or "Amount at Risk" method.

A. Corresponding Policy Form of the Reinsurer. The business is looked upon by the reinsurer in the same way as if received through one of its agents. The plan applied for to the original company is followed but the policy of the reinsurer is used as the basis of the reinsurance. For example, if the policy written by the original company is on the Ordinary Life form, then the reinsurer writes an Ordinary Life policy on its own form at its own premiums, commissions, nonforfeiture values, dividends if participating, and general contract provisions, with the original company stated as the beneficiary.

Even though the contract in general agrees closely with that of the original company, there may be serious discrepancies; for instance, the original company may exclude suicide within one year

only and the reinsurer within two years. If then the insured dies by suicide in the second year, the original company's policy is binding, but technically the reinsurance is not payable. Differences in surrender values and dividends, while apparently not serious in themselves, may prove a source of continual irritation. In general the plan is defective because the reinsurance does not cover precisely the same contingencies as the original policy.

B. Modification of the Original Company's Policy. Some of the difficulties under Plan A may be overcome by use of the policy form of the original company but with the premium, commission, and dividend rates of the reinsurer, although sometimes the participating policy of the original company is reinsured on the nonparticipating plan.

If the cost of insurance in one of the companies on a certain plan differs materially from the cost in the other company, there is likely to be dissatisfaction, and generally because of the hybrid arrangement, the results are less pleasing to the original company than if the reinsurance followed its own policy in all particulars.

C. Renewable Term Policy for a Level Amount. As the original company is interested chiefly in guarding against heavy loss from death, it may object to paying reinsurance premiums on Life or Endowment plans. Therefore, the protection may be obtained under a special One, Five, or Ten Year Renewable Term contract.

The plan is simple in application and meets the main conditions fairly well in the early years but when the net amount at risk has been considerably reduced by the accumulation of a substantial reserve, the amount of the reinsurance is larger than necessary. To meet this objection the reinsurance may be reduced at intervals as the reserve increases, but such a method is troublesome and unless care is exercised, reductions may be unfair to one or the other of the companies.

D. Coinsurance. When the basis of the reinsurance is the policy issued by the original company, a proportionate part of which in all particulars is assumed by the reinsurer, the plan is called "Coinsurance."

The premiums, nonforfeiture values, disability benefits, accidental death benefit, dividends if participating, and all other contract provisions apply in the reinsurance without modification. If the company grants a loan to the policyholder, apparently it can secure in turn a corresponding loan from the reinsurer.

Under such a treaty the following specific expenses are usually allowed:

1. Commissions according to the schedule of the original company;
2. Federal Tax of $0.08 per $100 of insurance;
3. A share of the medical and inspection fees;
4. State premium tax;
5. Miscellaneous expenses.

With respect to item 1, it is necessary to ascertain yearly for each reinsurance the commission actually paid to the agent under the policy reinsured, but if this detail appears objectionable, it may be avoided by means of a commission schedule so determined as to give substantially the same average results.

Item 2 refers only to new business but in view of the recent repeal of the Act, it has not been used for business written since January 1, 1922.

Item 3 may cover a proportionate part of the medical and inspection fees or only the excess over the amount that would have been paid in the absence of reinsurance.

Item 4 may be expressed for convenience as a level percentage of all reinsurance premiums, although the allowance may be granted only on residents of those states which do not permit the original company to deduct in its tax return the reinsurance premiums paid.

Item 5 covers such additional expense as it may seem proper to grant under the reinsurance, the allowance being stated usually as a percentage of the premiums.

Instead of applying items 3, 4, and 5 separately, it may be thought more convenient to ascertain a single percentage allowance including all three of them.

If the reinsurer is licensed in the same states as the original company, then the latter may take credit in its statement for the reserve on the proportion reinsured and thus transfer to the reinsurer the same proportion of the strain on surplus, a consideration of importance when the original company carries the full net level premium reserve under which new business causes a heavy strain on surplus.

If the original company carries reserves on the 3 per cent. basis, and the reinsurer ordinarily uses 3½ per cent. then the latter should employ 3 per cent. for the reinsurance in order to meet the cash values of the original company.

The principal advantage of Coinsurance is that the company is in the same financial position as if it had issued only its retention.

An objection is that although the reinsurance is primarily for the purpose of saving the original company excessive net loss on a single life, yet the company pays high premiums on the Life or Endowment form and thus is accumulating substantial reserves in the hands of the reinsurer. If the reinsurer is reliable and licensed in every state in which the original company transacts business, this is not a serious matter, although of course the company loses any interest it would have earned in excess of the actual rate required for stock premiums or mutual dividends. If the reinsurer is not licensed in every state, it may leave the reserve on deposit with the original company to protect the obligations under the reinsurance, but the exact status of this deposit in case of insolvency of either company is rather questionable. The deposit may be mingled with the other assets of the original company and credited with the average net rate of interest earned; or invested in specific securities, and the net earnings, losses, or profits thereunder transferred to the account of the reinsurer.

Coinsurance of participating contracts is handled for the most part by mutual companies, for a company writing direct business strictly according to the nonparticipating plan may feel that it would not be consistent to issue participating policies for purposes of reinsurance.

Although it is frequently said that the interests of the reinsurer are identical with those of the original company, yet they differ in certain important respects:

1. The reinsurance is centered on policies for large amounts on which presumably there will be a higher rate of mortality;
2. Much of the reinsurance occurs at the higher ages. Recent invesigations have shown that in many companies this portion of the business is least profitable, and in some companies, actually unprofitable. For the original company there is an offset in the profits arising at the younger ages and upon other forms of policies not so often reinsured, but there is no such offset for the reinsurer;
3. A heavier rate of termination in the early years on large policies particularly if the cash values are

unduly liberal throws a burden on the reinsurer. The reinsurer does not share in the gains arising from the more persistent policies for small amounts;

4. On the other hand, the reinsurer secures the business at a relatively low expense rate;
5. If the reinsurer earns a higher rate of interest than the original company, it has a profit from this source.

E. Amount at Risk. Under this plan the original company holds the reserve on the entire policy and secures reinsurance for the "Amount at Risk" in excess of its retention. This coverage is purchased on the One Year Renewable Term form.

Amount of Reinsurance.

The "nominal amount" of reinsurance is the excess of the amount issued over the amount retained. The actual amount each year is usually found by deducting from the nominal amount the reserve on the reinsured portion of the original policy. For instance, if the company issues $50,000 and retains $40,000, the nominal amount of reinsurance is $10,000. The actual amount each year is found by deducting from $10,000 the reserve on $10,000 of the original policy. Usually the terminal reserve is taken but the initial reserve may be used as it is on hand at the beginning of the year or the mean reserve as deaths occur on the average in the middle of the year. The net loss under a claim is the same as if the company had issued only the amount of its retention, because the portion reinsured is covered by the reserve thereon and the reinsurance.

In some treaties the amount of reinsurance each year is determined by deducting from the nominal amount the reserve on the entire original insurance. For example, if the original company issues $50,000, retains $40,000, and reinsures $10,000, the amount of reinsurance each year is found by deducting from $10,000 the reserve on the entire $50,000. When this reserve equals or exceeds $10,000, the reinsurance terminates. The original company's net amount at risk remains constant at $40,000 until the reinsurance terminates and each year thereafter decreases. The company thus carries less reinsurance than under the first plan but the arrangement is profitable if the saving in reinsurance premiums more than

offsets the additional net loss under claims. So far as the reinsurer is concerned, the reinsurance in force decreases rather rapidly with a corresponding reduction in the possibilities of profit or loss but on the other hand the method indicates that the original company expects a favorable mortality on large policies even after the effects of medical selection have disappeared.

When the original policy is on the Term plan, with relatively small reserves, the reserves may be ignored and the reinsurance carried from year to year at the full nominal amount.

When the original policy provides a continuous income to the beneficiary, the amount of insurance is the commuted value of the income for the certain period, plus the value of the deferred life annuity to the beneficiary. For the reinsurance, therefore, the amount at risk each year should be adjusted to correspond with the reduction in the value of this deferred annuity as the beneficiary grows older. This reduction may be based on the portion of the policy reinsured, or on the entire amount of the insurance.

Premiums.

The premiums are calculated at One Year Renewable Term rates from a table expected to meet the mortality under the particular agreement, with proper loading for expenses, contingencies, and profit. Under each reinsurance the premium for any year depends on the age attained by the insured at the beginning of the year, and the amount of reinsurance then in force.

These premiums are not subject to renewal commissions, but frequently the first premium is made especially low as a partial offset to the initial commission paid by the original company.

The premiums are in general too low to warrant an allowance for medical fees, inspection fees, and state premium taxes.

Mortality Savings.

Because any mortality profit to the reinsurer is due in part to the selection exercised by the original company, the agreement may include a provision whereby the company receives a given portion of the savings from favorable mortality. The expected mortality is computed by a specified mortality table, or as a percentage of the reinsurance premiums paid or earned, and the savings consist of the excess of this expected mortality over the actual mortality.

Two methods of computing and distributing the mortality savings are in use:

1. The excess of the expected over the actual mortality for a period of one, two, three, four, or five years is determined and a definite percentage thereof paid to the original company at the end of each period. If during any period the actual losses exceed the expected, then the entire loss is borne by the reinsurer; the original company shares only the profits.
2. (*a*) The profit or loss is computed as in method (1) but if the result for any period is a loss, this loss is carried forward and charged against profits of the succeeding period or periods. The original company receives no payment thereafter until the net result is a profit.

   (*b*) At the end of each period, usually one year, the profits and losses are accumulated from the commencement of the reinsurance agreement by calculating the expected mortality for the entire duration and subtracting from it the actual mortality. The stated percentage of the profit, less the amounts previously paid as mortality savings, is paid to the original company as savings for the year. If the expected mortality is less than the actual mortality, strictly speaking the original company should make a refund to the reinsurer, but in practice the entire amount previously received as mortality savings is retained.

   If the fundamental assumptions are the same in methods (*a*) and (*b*), they give identical results.

Permanent Total Disability Benefit.

When the original policy contains a Permanent Total Disability provision, the risk is composed of two distinct parts:

1. The regular Life insurance benefit;
2. The Permanent Total Disability benefit.

The second part places upon the company a liability in addition to its liability under Life insurance alone. This additional liability depends upon the type of provision written by the orignal company. The following types are in use:

1. Waiver of premiums.
2. Waiver of premiums and payment of a monthly income of one per cent. of the insurance during the lifetime of the insured while disabled, and payment of the insurance at death or maturity. In some provisions under endowment contracts the income is not continued beyond maturity.
3. Waiver of premiums and payment of the insurance in 20 annual installments, the present value of the installments being equal to the amount of insurance. Upon death or maturity the commuted value of the remaining installments is payable in one sum. In some provisions the payments are continued after the 20 years as long as the disabled insured survives.
4. Waiver of premiums and payment of the insurance in equal installments over a period of 20 years, the balance of the insurance being payable in one sum if death occurs during the period. In some provisions the payments are continued after the 20 years as long as the disabled insured survives.

The reinsurance is intended to cover the additional loss due to permanent total disability.

Under Type 1 the loss consists of the premiums waived. The premium waived may be taken as the tabular net rate for the life insurance or as the corresponding gross premium or as this gross premium less any savings on account of commissions, dividends, and taxes.

Under Type 2 the loss consists of the premiums waived and the income paid.

Under Type 3 the disability benefit is equivalent to waiver of premiums and payment of the face of the policy upon disability instead of at death or maturity. The loss, therefore, consists of the premiums waived and interest on the amount of insurance from the date of the first installment until death or maturity. Any pay-

ments after the 20 years constitute a further loss similar to the income under Type 2.

Under Type 4 the company waives premiums and pays the face of the policy in installments beginning upon disability instead of in one sum at death or maturity. The loss, therefore, consists of the premiums waived and interest on each installment from the date of payment until death or maturity. Any payments after the 20 years constitute a further loss similar to the income under Type 2.

Frequently the clause provides that if disability occurs after age 60 premiums are waived and charged without interest as a lien against the contract. The loss is interest on the premiums so waived.

Reinsurance of the disability benefit may be conveniently treated as entirely independent of the life reinsurance just as if the two parts were written under separate policies. As the disability reserves are relatively small, reinsurance of this benefit is best handled by Coinsurance or its equivalent, even though the life reinsurance is on the Amount at Risk plan, the reinsurer covering a portion of the original disability benefit.

The reinsurance premium may be computed by either of the following methods:

1. The gross disability rates used by the original company less expenses such as commissions and taxes.
2. Special disability rates used by the reinsurer for the same benefits for all companies without regard to the rates and expenses of the original company.

The first method is strictly Coinsurance; the second is more convenient for the reinsurer.

Under Type 1 the reinsurer pays its share of the original company's premiums waived. Strictly speaking, the net loss consists of the gross premiums less commissions, dividends, and taxes saved. In practice, however, the reinsurer frequently pays its share of the tabular net rate or the gross premium for life insurance under the original policy, with a corresponding charge in the disability reinsurance premium. If the full gross premium is covered by reinsurance, the company is really purchasing more reinsurance than it requires.

Under Type 2 the reinsurer pays its share of the original pre-

miums waived and income paid. In order to avoid misunderstanding, the reinsurance certificate should describe the disability coverage in detail,—for example:

a. $200 yearly premium waiver;
b. $100 monthly life income.

Under Type 3 the reinsurer pays its share of the premiums waived and of the loss on account of installments paid. As this loss consists of interest on the face of the policy, the reinsurer pays interest on the face amount reinsured for disability. If the original company continues payments beyond the 20 years, then the reinsurer pays its share of these items. The life reinsurance remains in force unchanged subject to payment of premiums. If the disabled insured recovers, and the insurance reinstated is the commuted value of the unpaid installments certain, for example $415 on each $1,000, the reinsurer continues to pay its share of the premiums waived and interest loss on the remaining $585.

If the original policy is a Term contract, the loss may be taken as waiver of premium and payment of interest until death if death occurs within the term period. If death does not occur within the period, the loss may be taken as waiver of premium, payment of interest until expiry and payment of the face amount at expiry. If, therefore, the disabled insured lives until expiry, the reinsurer must pay on the portion reinsured for disability the waiver of premium, interest until expiry, and the face amount.

Under Type 4 the reinsurer pays its share of the loss on account of premiums waived and installments paid. The loss on each installment consists of interest from the date of payment until death or maturity. The reinsurer, therefore, pays its proportion of this interest loss consisting of interest on one installment during the first year, two installments during the second, etc. If the payments are continued beyond 20 years, the reinsurer pays its share of these items just as in Type 2. The life reinsurance continues in force unchanged subject to payment of the reinsurance premiums. If the original policy is a Term contract and if the disabled insured lives until expiry of the Term policy, the reinsurer must pay not only interest but a special amount at expiry just as in Type 3.

The above plan of handling reinsurance under Types 3 and 4 may be called the "Interest Method." It simplifies the accounting of claim payments and the treatment in case of recovery.

An alternative known as the "Instalment Method" may also be used.

In applying the Instalment Method to Type 3 it is considered that upon death or disability all premiums cease and the policy becomes a claim for the face amount payable in one sum or in equivalent installments. Under either claim the net loss on the original policy is the net amount at risk. The reinsurer receives its proportion of the disability premiums on the Coinsurance plan or its equivalent and when a disability claim occurs, must cover the net loss on the portion reinsured. If, for instance, the nominal amount of reinsurance is \$1,000 with reserve of \$200, the net loss is \$800. The original company at once begins to pay installments on \$1,000. 20 per cent. of each installment is provided from the reserve held by the original company and 80 per cent. is paid by the reinsurer. The payment of these installments constitutes full settlement of both the life and the disability portion of the reinsurance. Upon recovery if the original policy is reinstated for the commuted value of the remaining installments, for instance, \$415 on each \$1,000, then the reinsurance is also reinstated for the net amount at risk on \$415.

To prove that the value of the disability payments by the reinsurer under the Instalment Method is the same as under the Interest Method, assume that under a Whole Life policy disability occurs in the mth year just before the $(m+1)$th premium is due and continues for s years when the Insured dies.

At disability the value of all reinsurance payments under the Instalment Method is the net amount at risk, $1 - {}_mV_x$.

Under the Interest Method the reinsurer pays π_x each year covering premium waiver and iv each year covering interest loss (i being at the valuation rate and paid in advance). The present value of these payments is $a_{\overline{s}|}(\pi_x + iv)$. At death, the life reinsurance of $(1 - {}_{m+s}V_x)$, (net level premium valuation) becomes payable, so that the present value at disability of the total payments thereafter made by the reinsurer is

$$a_{\overline{s}|}(\pi_x + iv) + v^s(1 - {}_{m+s}V_x). \qquad (1)$$

On the other hand, the reinsurer continues to receive the life reinsurance premiums, and their present value, ignoring the load-

ing required for expenses, is

$$vq_{x+m}(1-{}_{m+1}V_x)+v\cdot vq_{x+m+1}(1-{}_{m+2}V_x)+\cdots$$
$$+v^{s-1}\cdot vq_{x+m+s-1}(1-{}_{m+s}V_x), \qquad (2)$$

where vq_{x+m} is the one year term net premium and $(1-{}_{m+1}V_x)$ the amount of reinsurance in force in the $(m+1)$th year.
Now

$$({}_tV_x+\pi_x)(1+i)-q_{x+t}(1-{}_{t+1}V_x)={}_{t+1}V_x,$$

which may be expressed as

$$vq_{x+t}(1-{}_{t+1}V_x)={}_tV_x+\pi_x-v\cdot{}_{t+1}V_x. \qquad (3)$$

Substituting in (2) the value of $vq_{x+m}(1-{}_{m+1}V_x)$, etc., as given in (3) gives as the value of (2)

$$\begin{aligned}&{}_mV_x+\pi_x-v\cdot{}_{m+1}V_x\\&+v\cdot{}_{m+1}V_x+v\cdot\pi_x-v^2\cdot{}_{m+2}V_x\\&+\cdots\cdots\cdots\cdots\cdots\cdots\\&+v^{s-1}\cdot{}_{m+s-1}V_x+v^{s-1}\cdot\pi_x-v^s\cdot{}_{m+s}V_x.\end{aligned} \qquad (4)$$

But (4) reduces to

$${}_mV_x+\pi_x\cdot a_{\overline{s}|}-v^s\cdot{}_{m+s}V_x. \qquad (5)$$

The value of the net payments by the reinsurer is the excess of (1) over (5), that is,

$$[a_{\overline{s}|}(\pi_x+iv)+v^s(1-{}_{m+s}V_x)]-[{}_mV_x+\pi_x\cdot a_{\overline{s}|}-v^s\cdot{}_{m+s}V_x]$$
$$=iva_{\overline{s}|}+v^s-{}_mV_x=iv(1+i)\left(\frac{1-v^s}{i}\right)+v^s-{}_mV_x$$
$$=1-{}_mV_x. \qquad (6)$$

(6) is the life reinsurance in force at disability, and agrees exactly with the value of all payments under the Instalment Method described above.

In applying the Instalment Method to Type 4 it is considered that upon disability all premiums cease and the policy becomes a claim for the face amount payable in instalments—for instance, 20 annual instalments of $50 on each $1,000. If at subsequent death the commuted value of the remaining instalments is paid in one sum, then the total liability upon disability is the present value of 20 instalments certain of $50 each, which, at 3½ per cent. interest, is $735. If the reserve held by the original company is $200, then the remaining liability of $535 must be covered by the reinsurer. This means that out of each instalment of $50 the reserve con-

tributes 200/735 and the reinsurer 535/735. Sometimes the policy provides that at death the beneficiary shall receive the difference between the face of the policy and the instalments already paid. In this case the amount payable at death is more than the commuted value of the unpaid instalments and on the portion reinsured the excess must be paid by the reinsurer.

The limit of retention for disability need not be the same as the limit for life insurance. For instance, the disability retention may be the benefits issued with $10,000 of life insurance, although the retention for life insurance is $20,000. Hence, a policy of $20,000 will require reinsurance of the disability benefits on $10,000, but no life reinsurance. On the other hand, if the company already has $20,000 insurance in force without disability and later issues a $10,000 policy with disability benefit, it requires $10,000 life reinsurance, but no disability reinsurance.

Furthermore, the retention may depend on the nature of the disability benefit. For example, the disability retention may be premium waiver and monthly income under $10,000 of life insurance. In this case, if existing insurance contains only the premium waiver benefit, then under a new application with premium waiver and monthly income, reinsurance may be required only for the premium waiver portion.

The profit or loss to the original company under the disability provision is shared on a pro rata basis by the reinsurer and, even more than in life insurance, will probably be determined by the principles of underwriting and claim settlement of the original company.

Additional Accidental Death Benefit.

When the original policy contains a provision for payment of an additional amount in case of death by accidental means, the risk is composed of two distinct parts:

1. The regular Life insurance benefit;
2. The Additional Accidental Death benefit.

The second part places upon the company a liability in addition to its liability under life insurance alone. Reinsurance of the accidental death benefit may be conveniently handled by treating it as entirely independent of the life reinsurance just as in the case of disability benefits. As the reserves for accidental death benefits

are relatively small, reinsurance of this provision is best met by Coinsurance or its equivalent even though the life reinsurance is on the Amount at Risk plan. In that case the additional benefit payable only for accidental death remains constant from year to year regardless of changes in the amount at risk under the life portion.

Premiums for this Accident reinsurance may be computed by either of the following methods:

1. The gross rates used by the original company less expenses such as commissions and taxes.
2. Special accidental death rates used by the reinsurer for all companies without regard to the rate and expenses of the original company.

The first method is strictly Coinsurance but the second method is more convenient for the reinsurer.

The reinsurance certificate should show the extra premium for the accident benefit and in order to avoid misunderstanding when a claim occurs, it should state also the amount of the additional benefit.

In the event of death due to accidental means the reinsurer pays the regular life reinsurance then in force and the amount of additional benefit. For instance:

Regular life reinsurance (net amount at risk)	$ 800
Additional benefit	1,000
Total	$1,800

The limit of retention for accidental death need not be the same as the limit for life insurance. For instance, the limit for life insurance may be $20,000 but for the accident feature only $10,000. In this case a policy for $20,000 requires no life reinsurance but $10,000 accident reinsurance. On the other hand, if the company does not wish to be liable for a greater amount than $20,000 under any claim, then a policy for $20,000 with additional accidental death benefit requires reinsurance of the entire accidental death benefit or, say, $10,000 of the life benefit and $10,000 of the accident benefit.

If the additional death benefit is canceled under the original policy because of attained age or for some other reason such as payment of a claim under the disability provision, the accident rein-

surance ceases automatically and no further premiums for this benefit are payable. The life reinsurance, however, continues exactly as if there had never been reinsurance of the accident feature.

Complete Coverage.

When the original policy contains both Disability and Accidental Death benefits, the risk is composed of three distinct parts and the reinsurance of each may be treated independently of the others.

When the amounts of reinsurance under the life part are obtained by deducting from the nominal amount the reserve under the entire original insurance, the life reinsurance will terminate in many cases before the disability or additional accidental death benefit ceases, since these are not on the Amount at Risk plan. Although a company might not wish to give a policyholder the option of continuing disability and additional accidental death benefits after termination of the life insurance, the reinsurer extends such coverage to the original company. This merely illustrates the flexibility of the modern reinsurance treaty.

Advantages.

Although the Amount at Risk plan with yearly change in the reinsurance and in the premiums and with the calculation of mortality savings may seem complicated, in reality the fundamental principle is simple and there is a distinct saving in detail in the absence of commissions, dividends, and surrender values.

This plan is well adapted to the needs of the original company, particularly if the risk on one life involves several policies issued on different plans or at different times. Under a joint life policy where reinsurance is required on only one life, the method can readily be applied.

The original company retains the reserve in its own investments and secures at a minimum outlay protection exactly fitting its requirements.

An advantage to the reinsurer is that premiums and reserves are independent of the form and source of the original policy. When several companies exchange reinsurance under a reciprocal arrangement, the Amount at Risk plan is most advantageous as all companies can use a single set of rates.

VIII. The Cost of Reinsurance.

The expenses of the original company may be divided into two classes:

1. Expenses, such as commissions and state premium taxes, which depend directly on the volume of business and which therefore will be increased by the issuance of additional amounts covered by reinsurance.
2. Miscellaneous expenses, such as salaries and general home office and agency items for overhead and development, which will not be materially altered by issuance of additional amounts covered by reinsurance.

The premiums necessarily contain a margin to cover both these classes.

If the company can issue ten millions without reinsurance, but actually issues eleven millions and reinsures the extra million, then the expenses in class 1 are increased 10 per cent., but the expenses in class 2 remain practically the same as if only the ten million had been issued. If the extra million is coinsured, then all the extra expenses coming in class 1 are borne by the reinsurer and, as far as expenses are concerned, the company is left in the same position as if it had not issued the additional million. Therefore, without increasing expenses or liabilities, the company enables its agency force to increase the production 10 per cent.

If the extra million is reinsured on the Amount at Risk plan, the protection needed is purchased at a minimum premium and the actual cost in gross reinsurance premiums less the share of mortality savings is offset by the following items:

1. The mortality element in the original premiums.
2. Part of the expense element in the original premiums.
3. The interest earned on the reserve in excess of the rate assumed in the dividend formula if the policy is Participating, or required by the premiums if Nonparticipating.

Occasionally an attempt has been made to draw a distinction in reinsurance between Participating and Nonparticipating policies. It is probable, however, that there is just as great a distinction

between two Participating companies or between two Nonparticipating companies as between a Participating company and a Nonparticipating company. Both Participating and Nonparticipating insurance are freely sold in competition and the net cost to the policyholder depends much more on the efficiency of the particular company than on the form of organization, being determined under both plans by the actual mortality, interest earnings, and expense rate, over a long period of years.

The choice between Coinsurance and Amount at Risk depends upon the individual preference of the company. In general the former is more popular in the East and the latter in the West.

After all, the vital point is not the cost by this plan or by that plan, so long as it is reasonable, but rather certainty of protection and maintenance of relations along friendly and co-operative lines.

IX. The Reinsurance Treaty.

Facultative. For facultative reinsurances where there exists no oligation to offer or accept any risk a treaty is not essential, since the terms and conditions may be stated in each certificate or policy of reinsurance.

However, an understanding concerning the classes of risk, the limits of acceptance, the plan of coverage, reductions, and the rules of procedure is helpful to both companies.

Automatic. For automatic reinsurances a treaty is necessary.

Such an agreement must state clearly, with respect to Life, Permanent Total Disability, and Additional Accidental Death benefits, how much of the excess of each risk is to be ceded to and accepted by the reinsurer. The excess may be referred to, briefly, as "First Surplus" or "Second Surplus," but the term used should be defined either in the treaty itself or in a supplementary schedule. An exhibit showing for each age group, policy form, and class of benefit the two amounts between which the interest of the reinsurer lies is recommended.

Standard Lives. If the arrangement applies only to standard lives, or to standard lives on one basis and all others on a different basis, then the meaning of "Standard Lives" should be defined.

If the original company charges an extra premium, rates up the age, restricts the coverage or form of contract, or retains less than its regular limit, the risk should be classified as "Substandard."

Since under automatic reinsurance the underwriting of the original company governs, the term "Standard Lives" may be defined as "Lives upon which the original company issues at its manual premium rates without extra charge the amount and form of contract for which application was made, and upon which the original company retains its maximum limit for that age, sex, and form of contract."

Substandard Lives. If the arrangement applies also to substandard lives, then the basis and limits governing such risks should be clearly set forth in the treaty.

Plan of Reinsurance. The plan of reinsurance should be stated, and if Amount at Risk, a rule given for calculating the yearly amounts of life coverage.

Liability of Reinsurer. Facultative reinsurances are effective from the date of acceptance or from the effective date of the original policy if that date is later.

Under automatic coverage, the liability of the reinsurer commences simultaneously with that of the original company even though the reinsurer at that time may not have received any notice of the cession. However, the original company is obliged to give notice of each risk within a certain number of days and at the same time to forward copies of all papers pertaining to the risk.

In either case, the reinsurance policy usually bears the same date as the original policy in order that the premium dates may correspond.

The reinsurance is intended to begin and end simultaneously with the risk of the original company, and the treaty should provide that if the original company is liable, then the reinsurer also is liable.

Policy Forms. Because the reinsurance is payable under the same conditions as the original insurance, the reinsurer should be furnished with a copy of the policy issued to the policyholder. If only a few reinsurances are likely, it is more convenient to use a copy with each case, but if frequent cessions are expected, then a complete set of all policy forms should be filed by the original company, the reinsurer giving its approval of each form in writing or signifying that it does not care to provide coverage under a form which it considers objectionable.

Schedules. A complete schedule of premiums, commission and expense allowances if any, should be attached to the treaty, and if the plan is Coinsurance, the entire rate book and dividend pamphlet

of the original company must be incorporated in the treaty at least by implication, as the reinsurance applies to surrender values and dividends.

If the original company is to share in mortality savings or in other profits, the basis and method of calculation must be clearly described.

Monthly Statements. For the convenience of both companies the reinsurance premiums are usually paid on an annual basis without regard to the manner of payment by the insured, and if the reinsurance is reduced or terminated, the original company is credited with a refund of the proportionate unearned part of the premium.

About the tenth day of each month the original company sends the reinsurer a statement showing all first year and renewal premiums then payable, together with any adjustments made necessary by changes in reinsurances, and transmits with such statement the net amount shown therein as due the reinsurer. If the balance is due the original company, it may be immediately paid by the reinsurer or used as a credit in the next statement.

The statement shows the renewal premiums falling due during the preceding month without regard to whether the premiums on the original policies have been paid or are still outstanding. As the original company need not notify the reinsurer of lapse until reasonably sure that the original policy will not be reinstated, this method eliminates most of the adjustments and readjustments necessary under lapses which are subsequently reinstated.

Occasionally it has been claimed that in the payment of reinsurance premiums in this way the original company does not receive the same grace period as the insured. However, when the renewal date is at the first of the month, the grace period for the reinsurance is forty days and when the renewal date is at the end of the month, the grace period is ten days, so that assuming uniform distribution, the average is twenty-five days, which is probably fully as long as the average grace period taken by the insured.

With respect to first year reinsurance premiums, two methods of payment are in use:

1. The first premiums are treated in the same way as renewals, that is, they are paid whether or not the original policies have been paid. If it develops later that a policy has been canceled as "Not Taken," a refund of the reinsurance premium is made.

2. The first premiums are settled in the monthly statement for the month in which the corresponding insurance premium has been reported paid. Under this plan it is necessary for the reinsurance department of the original company to keep constantly in touch with the status of all new business reinsured. On the other hand both companies are relieved of the extra accounting work under the first method, occasioned by the payment and refund in connection with reinsurances which are ultimately "Not Taken," and also in connection with any changes made before the original policy is finally accepted by the insured.

The monthly statement method of reinsurance premium settlement eliminates premium notices and receipts for specific cases. Less clerical work is required and if the statement is carefully prepared by the original company and checked by the reinsurer, greater accuracy is secured than if each case were handled individually.

It may be found convenient for the original company to send a special statement near the year end in order to reduce as far as possible for both companies all outstanding premiums.

Changes. If the provisions or conditions of a reinsured policy are changed and such change is material to the reinsurance, then the original company should immediately inform the reinsurer and if any extra premium is received by the original company, a corresponding extra should be paid to the reinsurer.

If the original policy is on the Term form and is converted to the Life or Endowment form, then the reinsurance, whether Coinsurance or Amount at Risk, should be correspondingly changed.

When the original policy is changed to extended term insurance, the coverage, if Coinsurance, is changed to extended term, but if Amount at Risk, it may be changed to an amount for the extended term period by payment of a single premium, or continued at the regular One-Year Term rates for the yearly amounts at risk under the extended insurance.

Reductions and Terminations. When the total insurance issued by the original company upon an individual life is canceled, the reinsurance also is canceled forthwith.

When the original insurance is reduced, the reinsurance also is

reduced and the reduction may be effected according to either of two plans:

1. The reinsurance is reduced by the amount of reduction in the original insurance. This follows from the principle that reinsurance is required only so long as the total amount of insurance exceeds the retention of the original company.
2. The reinsurance is reduced in the same proportion as the original insurance. This follows from the principle that the reinsurer should be interested in a risk as long as the original company is interested.

Whichever method is adopted for any particular treaty should be applied in all cases thereunder as it is not fair to the reinsurer to apply at the option of the original company a proportionate reduction in one case and an absolute reduction in another.

When only one reinsurer is interested in the risk, the different adjustments which arise may be classified as follows:

Under plan 1—

a. Reduction in the policies which occasioned the reinsurance. The reinsurance should be reduced by an equal amount.

b. Reduction in the policies issued prior to the reinsurance. The reinsurance should be reduced by an equal amount.

c. Reduction or termination of the policies issued subsesequent to the reinsurance. The reinsurance should remain unchanged.

Under plan 2—

a. Reduction in the policies which occasioned the reinsurance. The reinsurance should be reduced in the same proportion as these policies. If the insurance requiring the reinsurance is terminated, then the reinsurance also should be terminated.

b. Reduction in the policies issued prior to the reinsurance. The reinsurance should be reduced in the same proportion as the total insurance on the risk, exclusive of policies issued after the reinsurance.

c. Reduction or termination of policies issued subsequent

to the reinsurance. The reinsurance remains unchanged.

When several companies are interested in the risk, complicated situations are bound to arise because the reduction provisions in the various treaties are not always alike but each case should be handled in such a way as to meet substantially the different provisions. No rule or set of rules can be formulated which will apply without modification in all cases, but in the main the requirements of the several treaties can be so followed that none of the reinsurers need be dissatisfied. One of the following principles may govern the distribution of reductions among several reinsurers:

a. The reduction is applied to all reinsurers according to the proportionate interest of each, regardless of when the insurances and reinsurances were issued.

b. The reduction applies only to those companies reinsuring the particular policy or policies reduced or terminated.

c. The reduction applies inversely to the order of cession, that is, the reinsurance last made is first canceled. This is upon the basis that the reinsurer covering the first excess should continue to cover that excess as long as any of it continues, and thus for the second excess, etc.

The reduction or termination of any reinsurance because of the reduction or termination of the original insurance upon the same life is automatic as of the effective date of the insurance, notwithstanding that notification may not reach the reinsurer until a considerable time has elapsed. Therefore, the unearned reinsurance premium to be refunded to the original company should be calculated from the effective date of cancelation.

In most cases the insurance is canceled as of the date upon which a premium or note is due and the unearned reinsurance premium should be calculated from that same date. The reinsurer thus allows without charge the same grace period as the original company.

Reinstatements. If the reinsurance was automatic originally, then any reinstatement thereof should be automatic.

If the reinsurance was facultative originally, then strictly speaking any reinstatement thereof should be facultative. However, in

practice the reinsurer customarily follows the original company in any action taken on a risk already accepted for reinsurance.

Whether facultative or automatic, the treaty may contain a provision that reinstatement of a reinsured policy shall apply to the reinsurance if written notice of such reinstatement is given to the reinsurer within a certain time.

Claims. When a claim for death or disability is made upon the original company under a policy reinsured, prompt notice should be given to the reinsurer, followed as soon as possible by complete copies of the proofs. The proofs accepted by the original company should likewise be taken as sufficient by the reinsurer. Upon receipt of such papers and copies of the checks and releases of the original company, the reinsurance becomes payable forthwith.

Under the Amount at Risk plan, the reinsurance is usually payable in one sum irrespective of the mode of settlement under the original insurance. If the plan of coverage is Coinsurance, then the reinsurance settlement conforms to any installment settlement of the original insurance.

The original company may consult with the reinsurer regarding the contest of any claim, but the decision of the original company or of a court of law is binding on the reinsurer.

The reinsurer participates in the reduction by any defense or compromise and bears its proportionate part of the actual cost of defending against or compromising any reinsured claim. The actual cost includes all legal, traveling, and other specific expenses, but not any part of the regular salary or office expenses of the original company.

When the plan of coverage is Coinsurance, the payment to be made by the reinsurer under a death claim settled either for its full amount or for a smaller amount as a result of defense or compromise is determined by the proportion the reinsurance bears to the total amount of insurance.

When the plan is Amount at Risk, the reinsurance applies only to the risk in excess of the reserve. Therefore, under any death claim, whether settlement is for the full or a smaller amount, the reinsurer is interested only in the amount paid over and above the reserve. The excess of the payment over the reserve represents the net loss to the original company and such net loss is divided proportionately between the company and the reinsurer. For example, suppose under a $10,000 policy, half of which is reinsured,

the reserve at death is $2,500, and the reinsurance then in force is $3,750. If the claim is paid in full, the net loss to the company is $7,500 and 50 per cent. thereof, or $3,750, is borne by the reinsurer. If the claim is settled for $5,000, the net loss is $2,500 and 50 per cent. thereof, or $1,250, falls upon the reinsurer. If the claim is settled for $2,500, the net loss is nothing and therefore the reinsurer should pay nothing.

"Lifted" Policies. When a contract is terminated by the company under a special settlement with the insured, before any claim has been incurred, the policy is said to be "Lifted."

The usual instance is when the company, after receiving one or two annual premiums, discovers there was misrepresentation or fraud and induces the policyholder to surrender the policy in consideration of a certain payment, consisting of the return of the gross premiums with or without interest. In such a case it may be held that the adjustment with the policyholder is on the assumption that the insurance never was in force. It follows therefore that the reinsurance never was in force and that the reinsurance premium should be refunded with or without interest, just as in the case of the original policy. If the agent acted in good faith and is allowed to retain the commission, then the reinsurer should allow the original company to retain the commission on the reinsurance. Under the Amount at Risk plan, if the first year premium carries a special allowance, then such allowance, for the purpose of settlement, may be looked upon as commission.

If the company settles with the policyholder by payment of the cash surrender value of the contract, adjustment under Coinsurance calls for payment of the proportionate cash value, but under Amount at Risk, the reinsurer should pay nothing because the payment by the original company is fully covered by the reserve.

If the amount paid the policyholder is not determined with any reference to the premiums or cash surrender value, then the interest of the reinsurer on the Amount at Risk plan applies only to the amount paid in excess of the reserve under the original policy.

Right to Inspect. It is customary to include a provision giving the reinsurer the right at all reasonable times to inspect at the office of the original company all books and documents referring to the business under the agreement.

Since the making of a treaty indicates the confidence of each party in the other, this right will be exercised rarely if ever, but

it gives protection to the reinsurer in case the management or control of the original company subsequently undergoes radical change.

Continuance of Reinsurance. The treaty should stipulate that the reinsurance shall be maintained in force as long as the original insurances on the same life are maintained in force; for otherwise the original company may assume that it can continue or discontinue any reinsurance at its option.

Invariably the original company has the right to increase its retention limit on new business requiring reinsurance by filing written notice with the reinsurer a reasonable time in advance, the new limits applying only to policies written after a specified date succeeding such notice.

If the company applies the increased limits to all policies previously reinsured, clerical work in connection with the reinsurance reductions may be saved by having such reductions take effect at the next anniversary date under each reinsurance.

Under a retroactive increase in limit, the first company takes over a large volume of business from which the effects of medical selection may or may not have entirely disappeared, and the reinsurer is relieved of liability on a number of risks which presumably would begin to show a higher mortality than in the early years.

Cancelation of all or any part of Coinsurance as a result of increase in retention requires payment by the reinsurer of the cash value on the amount of reinsurance thus terminated, but in some cases the reinsurer may pay more than the cash value if it is felt that the surrender change, consisting of the reserve less the cash value, more than offsets the acquisition expense.

Cancelation of Treaty. Either company can terminate the treaty as to new reinsurances at any time by giving sixty or ninety days' notice in writing to the other. The agreement continues operative in all particulars during such period, and after maturity of the notice of cancelation remains in force with respect to the reinsurances previously granted.

Arbitration. It is usually understood that the treaty shall be interpreted as an honorable engagement and not strictly as a legal document. But in order to facilitate the friendly settlement of any difference of opinion, such understanding may be stated in the treaty with a provision that in event of a dispute which cannot be settled by the companies, each shall appoint an arbitrator, that

these two shall select a third and that a majority decision of the three arbitrators shall be binding on both companies.

X. Office Practice.

The detail office work in connection with reinsurances may be conducted—

1. By the regular organization of the company, or
2. By the regular organization under the direction of a head thoroughly familiar with all the reinsurance arrangements of the company, or
3. By a special reinsurance department.

Under the first method, each part of the work is done in the same way as the corresponding part of the direct business; that is, new reinsurances are taken care of in the New Business Department, renewals in the Renewal Department, changes in the Change Department, claims in the Claim Department, etc. Provided each department is fully acquainted with the requirements of the agreements, this method should give satisfactory results. However, as the company grows and its reinsurance treaties increase in number, delays, errors and misunderstandings are likely to arise unless great care is exercised.

Under the second method, the concentration of responsibility tends to prevent misunderstandings but the possibility of delays and errors is not lessened appreciably because the work is done by clerks whose chief interest is direct business, or by special clerks under supervisors charged also with other duties.

Under the third method, all the details are handled and all the records kept in one department, thus eliminating delays and errors caused by the interference of other work. Some advantage may be gained by using certain other departments, such as the Medical and the Actuarial, but new business, renewals, changes, reinstatements, and accounting are handled primarily by the Reinsurance Department and statements or reports relating to reinsurance are made from statistics based upon the records in that Department. The fact that all correspondence relating to reinsurance is conducted by a single department is of almost vital importance.

The Reinsurance Department is required to obtain coverage for the excess lines, which may be designated as "Reinsurance Ceded."

and to handle reinsurances from other companies, which may be designated as "Reinsurance Acquired."

A. Reinsurance Ceded. When the amount of insurance already in force and the new insurance applied for exceed the retention limit, the case should be referred to the Reinsurance Department in order that the necessary coverage may be obtained.

Whether the reinsurance is automatic or facultative is for the Reinsurance Department to determine, but in any case the policy should not be released to the agent for delivery until the reinsurance has been secured.

If a reinsured policy is approved for reinstatement, reference should be made to the Reinsurance Department before notification of approval is given to the agent.

Under automatic agreements the coverage is effective immediately upon approval of the risk by the original company, but while the underwriters may decide to accept a certain borderline case, they may not care to impose the decision upon the reinsurer and therefore may request the Reinsurance Department to treat the excess as facultative.

Again, information possessed by the Reinsurance Department concerning the practices of the reinsurer with respect to certain types of risks may warrant the submission of such risks as facultative rather than automatic.

In calculating the reinsurance required, the face amount of existing insurance should not always be used, as the accumulated reserve may be considerable. For example, suppose there is in force a Ten-Year Endowment for the retention limit of $5,000, and the new application is for $5,000. If the Endowment is about to mature, there is no actual risk thereunder and the new policy can be issued without reinsurance. If the reserve under the Endowment is $3,000, then the amount at risk is $2,000 and the company can retain $3,000 of the new insurance, thus obtaining reinsurance of only $2,000. Usually the reserves under existing policies are much smaller than the amount used in the illustration, but if they are not considered, the company secures more coverage than actually needed.

Having obtained reinsurance for a risk, the Reinsurance Department should keep such records that any information may be obtained accurately and quickly. Records along the following lines serve this purpose:

1. An index card showing the name of the risk, the numbers of the insurance policies, the names of the reinsurers, and the month of renewal. These cards are filed alphabetically and are useful for the location of other reinsurance records upon that life.
2. A new business card to show the details of the reinsurance work on that risk from the time the case is received in the Reinsurance Department until it is definitely settled and all Reinsurance Department records are complete. These records may be numbered consecutively in order to determine that none is missing. A similar card of different color may be used for changes and cancelations.
3. A large card for each reinsured life, on one side of which are shown the facts as to the insurance, such as state, branch office or general agency, numbers, dates, forms, amounts, and agents, and on the other side, the various reinsurances in force. These cards may be kept in two files:
   a. Active cards filed by tabs showing the months in which the renewal premiums fall due; that is, all the June tabs filed together, and all the July tabs, etc. When one card has more than one tab, the filing may be by the one nearest the beginning of the year.
   b. Dead cards filed alphabetically, those canceled in the current year being kept separate until the end of the year.
4. A list of reinsurances for each reinsurer, subdivided by month of renewal, showing number of the reinsurance policy, name of the risk, and state of residence. In some instances a further division may be advisable, depending upon the reinsurance relations with the particular company. For instance, the agreement may have been changed and the business should be separated, or the reinsurance may have been obtained on the policy form of the reinsurer, requiring conversion within a certain period, which fact is indicated in the list in order that it

may not be overlooked at the expiry of the conversion period.

5. A permanent register for each reinsurer showing all the details of each reinsurance, including the amounts paid or received thereunder by years. This furnishes a permanent and complete history of each reinsurance and from it any information relating to reinsurance and for any period can be obtained. This same information may be derived at the same time from the cards, thus furnishing an independent check.
6. A chronological file of monthly statements separated by companies.

The issuance of certain policies on a life may be the direct cause of reinsurance, but any change in the other policies on the same life may affect the reinsurance. Therefore, all records of policies upon lives reinsured should be conspicuously marked "REINSURED," in order that the Reinsurance Department may be notified when any change or cancelation occurs. As a further safeguard the Reinsurance Department should compare the records of its changes periodically, say every six months, with the same records in another department, such as the Actuarial. If it is the general practice of the company to withhold payment of new reinsurance premiums until the corresponding insurances are reported paid, then when a report is received that a new reinsured policy is paid for, the Reinsurance Department should be promptly informed. However, the Reinsurance Department may protect itself in this connection by obtaining special reports from the proper department when the policies have been outstanding for some time.

No set of rules which will operate infallibly can be formulated for the guidance of other departments with regard to reinsured policies. Consequently if the Reinsurance Department wishes its records constantly up to date and correct, it should periodically make investigation in order to ascertain whether it has received advice regarding all changes and cancelations of policies on reinsured lives.

B. Reinsurance Acquired. Under facultative cases requiring the decision of the reinsurer, the regular underwriting staff of the company may be used to advantage, but they should be followed

closely by the Reinsurance Department to insure prompt service and in order that differences in the underwriting practices of the companies may be taken into consideration. For instance, when the applicant is known personally to the officers of the original company and therefore an inspection report is not obtained, the reinsurer also may waive such requirement. If the rules of the original company do not call for a microscopic urinalysis, then the reinsurer may disregard its own rules in that respect if the risk appears otherwise satisfactory.

Very often complete papers are not given to the reinsurer, the approval of the original company being subject to an additional report, such as inspection, blood-pressure reading or urinalysis. For the purpose of expediting the release of the policy, the reinsurer may approve the reinsurance with the understanding that the additional information will be accepted as satisfactory if it proves satisfactory to the original company.

Automatic cases also should be underwritten so that the reinsurer may keep in touch with the selection of the original company. However, this business for the most part may be reviewed in the Reinsurance Department.

Records along the same lines as those for the Reinsurance Ceded will be found suitable:

1. An index card showing the name of the risk, date of birth, occupation, numbers of all reinsurance policies issued, with names of the original companies, and any impairments. Such alphabetical file for the use of the Reinsurance Department alone is not necessary if the regular file of the company includes reinsurances.
2. A new business card showing name of the original company, name of the insured, age at issue, state of residence, kind of reinsurance, number of reinsurance application, date of reinsurance application, date received, amount of Life reinsurance, amount and kind of Disability reinsurance, amount of Accidental Death reinsurance, reinsurance policy number, date of reinsurance policy, date reinsurance policy mailed, date of payment of first premium, form of original policy, total insurance

issued by original company, total insurance retained by original company, other insurance issued by the reinsurer on the same life, occupation, impairments, and special underwriting features. For automatic cases white cards may be used and for facultative cases, buff cards. These cards are filed by companies and when the case is completed by payment of the first premium, or by cancelation as "Not Taken," and the card has been used in all monthly statements made from this file, it may be placed in another file, kept by companies.

3. A permanent register for each company showing all the details of each reinsurance, putting the amounts paid or received thereunder by years, furnishes a permanent and complete history of each reinsurance available for statistics.
4. A card showing number of reinsurance policy, age at issue, date of reinsurance, state of residence, form of reinsurance, amount of Life reinsurance, amount of Accidental Death benefit, amount of Disability benefit, first year premiums for each of these benefits, name of company, and on the reverse side, amounts of Life reinsurance from year to year. These cards are filed by number and from them statistics as to reinsurance issued, canceled, and in force, and mortality and lapse rates may be obtained.
5. Cards used in checking monthly statements of account separated by companies and filed according to tabs showing month of renewal. These cards show simply the number of reinsurance policy, name of insured, date of issue, and the record of the date and amount of premium payments.
6. Chronological file of monthly statements separated by companies.

XI. The Outlook.

Five years ago it was difficult for an American company with retention of $50,000 to secure satisfactory reinsurance for another $50,000 and thus enable its agents to sell $100,000 on one life.

Today a good company with retention of from $5,000 to $100,000 can readily obtain reinsurance at least equal to its retention. Not only can this additional coverage be secured from reliable reinsurers but it can be purchased on much more favorable terms than were formerly granted.

With improved reinsurance facilities and increased sale of policies for large amounts, several well-established companies formerly refusing to issue more than their retention have now extended their operations by means of reinsurance.

Nothwithstanding the recent development of reinsurance, it is probable that some companies which have so far held aloof will soon fall into line. Others which now issue double their retention will wish to handle three or four times that amount.

Reinsurance pools of several companies have been formed for the express purpose of exchanging reinsurance under a facultative or automatic agreement. Apparently some of the larger pools in an attempt to simplify the procedure and concentrate responsibility will operate through a central bureau used as a receiving and distributing office.

Reinsurance has enabled American companies to write larger policies and thus render greater service to the insuring public. It must also be of benefit to both the original company and the reinsurer provided the business is conducted on sound principles with integrity, confidence and cooperation.

Reinsurance.

BY

M. W. TORREY.

The subject of reinsurance has received very little attention from the Actuarial Society, and our President, Mr. Hutcheson, has suggested that a paper on the subject would be of interest. The only previous paper that I can find in the *Transactions* is that by Mr. Moir, Volume VII, October, 1902, since which time there has been a great change in the method and manner of conducting reinsurance.

At the present time the enormous increase in the number of large policies written both for family and business protection has rendered it necessary for the great majority of companies to have such reinsurance facilities as will enable them to take care of the applications written by their agents in excess of their own maximum retention. This is particularly true of the smaller and medium sized companies, otherwise their agents would have to form partial connections with other companies in order to take care of large applications, and this tends to demoralize an agency force. It is of the greatest importance in building up an efficient field organization, that the agents should, as far as possible, deal only with the company with which they are under contract, and not be forced to make connections with other companies to take care of their excess lines.

It is not intended in this article to go into a detailed discussion of the question of the amount which should be retained by various sized companies and the relative amount that should be reinsured. Suffice it to say, however, that the three principal factors to be considered in deciding the amount which a company can retain are the amount of business in force, the average size of its policies, and its surplus. It is manifest that of two companies with exactly the same amount of business in force and of the same average size of policy, if one company has a surplus twice the size of the other,

it can afford to carry a larger net retention than the other company.

As regards the amount which the insuring company should reinsure and the relationship of this amount to its own maximum retention, each company is more or less of a law unto itself. In the case of a small company which can retain only $5,000, it is clear that in order to hold its agency force, it is necessary for it to reinsure a much larger amount proportionately than in the case of a larger company.

The practice of some companies of issuing a policy for $100,000 and reinsuring $95,000 while only retaining $5,000 is probably too extreme. It would appear that if a company could only retain $5,000, it should not write a larger policy than $25,000 and reinsure $20,000. It should be borne in mind that the large policies of $100,000 and over do not as a rule go to the small companies unless there is a definite reason for it, and the issuance of such large amounts will therefore not inure to the advantage of the small companies.

Another point to be considered is that of commissions. Some companies try to adjust the agent's commission in connection with a large case requiring reinsurance. This is seldom practicable, and leads to more trouble and dissatisfaction than if the insuring company limited its policy to a more conservative amount and paid the agent commission thereon at his regular rate.

A number of States have laws as to the amount that can be reinsured by domestic companies. Indiana, Maine, Massachusetts, Minnesota, Mississippi, and North Carolina, limit the amount of reinsurance to one-half of the total insurance on a single risk. In Ohio the insuring company cannot reinsure in excess of four-fifths of the amount carried on an individual risk. In Oklahoma the insuring company cannot reinsure in excess of two-thirds of the amount carried on an individual risk. Connecticut will not permit the insuring company to reinsure in any other one company more than the net amount which it carries itself. A number of the States have laws which will permit the reinsurance of the entire amount of a risk upon receiving permission from the Insurance Commissioner.

In allowing credit for the reserve on business reinsured, the States generally will allow credit if the reinsurance is in a company licensed to transact business in the State. A considerable number

of States will not allow credit for the reserve on reinsurances if the reinsuring company is not licensed to transact business in the State.

Most of the States will allow the reinsurance premiums paid to a licensed company to be deducted from the premium tax return of the insuring company. Other States tax the insuring company on the entire premiums in the State and place no tax on the reinsurance premiums received. Georgia, Missouri, and Nebraska, apparently tax both the insuring and the reinsuring company. This is double taxation and cannot be justified from any point of view.

Reinsurance in this country is conducted almost entirely under the two following forms:

Yearly Renewable Term. On this plan, the reinsurance is reduced each year as the reserve on the amount reinsured increases, the insuring company paying to the reinsuring company a nonparticipating Yearly Renewable Term premium at the attained age of the insured and for the then amount at risk. The rates for this form of reinsurance are generally based on the American 3½ per cent. table with a small loading of from 5 per cent. to 10 per cent. and instead of a first year commission it is usual to provide in the agreement that the first year's reinsurance premium should be one-half of the regular premium. No renewal commissions.

Coinsurance. On this plan the reinsuring company exactly duplicates the coverage of the insuring company, and the reinsuring company is paid a pro rata of the premium received by the insuring company, the reinsuring company paying first year and renewal commissions at the rate paid by the insuring company. The reinsuring company also allows surrender values and dividends at the rate of the insuring company.

A reinsurance agreement between companies can be made on either of the above plans and can also be either Automatic or Facultative. On the Automatic basis, the insuring company where it retains its full maximum retention, is obliged to cede to the reinsuring company its excess insurance up to a stated amount which is generally 100 per cent. of the retention of the insuring company, and the reinsuring company is bound to accept the same. On the Facultative basis, the insuring company is not obligated to submit its excess insurance to the reinsuring company, but may submit a

case or not as it deems expedient, and the reinsuring company is free to reject or accept each case.

Under an Automatic agreement if the insuring company desires an amount of reinsurance in excess of the amount which it can cede automatically, such excess can be submitted on the Facultative basis, either to the reinsuring company which receives its first surplus or to some other company with which the insuring company has reinsurance relations.

In considering the relative merits of an Automatic or a Facultative agreement, there are a number of things to be considered. If the insuring company has a considerable amount of reinsurance to place and has an experienced underwriting and medical department, an Automatic agreement is unquestionably the best, as it enables the insuring company to issue a policy for a considerable amount without waiting to hear whether or not the risk is acceptable to the reinsuring company.

If the insuring company's Medical Department is not thoroughly experienced and consequently has not learned that a risk must be looked at from the insurance point of view as one of a group and not as an individual from the point of view of the medical practitioner, a Facultative agreement with a larger and more experienced company is unquestionably the best. It often occurs that where a large risk has been turned down by one of the older companies for good and sufficient reasons, the agent then immediately endeavors to place the risk among the new companies.

Taking up now the question as to the preference of the insuring company for Coinsurance or Yearly Renewable Term reinsurance, experience indicates that the deciding factor is the size of the insuring company modified in a measure by the interest rate which it earns on its investments. The medium sized and the large companies almost invariably prefer to place their excess business under a Coinsurance agreement, while the smaller companies generally prefer a Yearly Renewable Term agreement, as such an agreement enables them to build up their assets through retaining the entire reserve. Where the insuring company has a high average interest rate, the excess interest earned on the reserve held by them on the amount reinsured will in a few years tend to compensate for the loss of the mortality profits on that portion of the risk reinsured. There are, of course, other features which enter into the question, but the two mentioned are apparently the deciding factors in the

mind of the executives of the smaller companies and outweigh any other *pro's* and *con's* and actuarial tables of comparative costs.

It may be well to review the principal features that should be covered in an Automatic agreement on the Yearly Renewable Term plan for standard risks, as that is the form of reinsurance which the majority of companies are interested in.

1. *Automatic Participation and Form of Reinsurance.* In each case where the insuring company retains its full maximum retention, it must cede automatically to the reinsuring company its excess insurance usually up to 100 per cent. of its own retention, and the reinsuring company must accept the same,—the reinsurance to be on the Yearly Renewable Term plan, for the net amount at risk, that is the initial amount of the reinsurance less the reserve on the amount reinsured. If the agreement is to cover the reinsurance of excess Disability Benefits and Double Indemnity, provision should be made for these features.

2. *Mode of Cession.* The clerical procedure should be set forth by which the insuring company within a stated period after issuing its policy, notifies the reinsuring company that it is automatically ceding reinsurance for a certain amount; copy of the application, policy, and other papers in connection with the insurance of the insuring company being sent with the automatic cession. The reinsuring company issues to the insuring company a certificate of reinsurance.

3. *Revivals.* If the insuring company revives any insurance in connection with which reinsurance has been granted, the reinsuring company automatically follows the action of the insuring company, provided that the insuring company within a stated period after reviving its insurance, notifies the reinsuring company as to such revival and forwards copies of all papers in connection with the revival. The insuring company pays to the reinsuring company in the next monthly account, the past due reinsurance premiums with interest at the same rate as paid by its policyholder.

4. *Premiums.* A table of the premiums to be paid by the insuring company to the reinsuring company for the Yearly Renewable Term reinsurance and also for the Disability Benefit and Accidental Death Benefit reinsurance, if any. In lieu of any first year commissions the usual practice is to provide that the first year's reinsurance premium shall be taken at one-half of the tabular rate. No renewal commissions.

5. *Payment of Reinsurance Premiums.* The premium on the reinsurance should be paid on an annual basis without reference as to how the premium of the insuring company is paid. If the insuring company's policy lapses for the nonpayment of a quarterly or semi-annual premium, and the insuring company has paid an annual premium to the reinsuring company, a refund is made of the unearned premium. It is also usual to provide that the reinsuring company is bound as the insuring company is bound, no matter whether the reinsurance premium has been paid or not.

6. *Accounts.* The insuring company should render monthly accounts, and in such accounts pay premiums on all new reinsurances, the premiums on which have been paid to the insuring company during the preceding month, and also pay the renewal premium on all renewal reinsurances which fell due the preceding month, credit being taken for any reinsurance premiums paid where the insuring company's policy lapsed on account of nonpayment of its premium. The account should be made in duplicate and forwarded to the reinsuring company which returns to the insuring company one copy of the account, duly signed, as the insuring company's voucher for the payment of the reinsurance premiums. (This does away with the necessity of issuing premium notices and individual premium receipts in connection with reinsurances.)

7. *Reduction in Insuring Company's Policy or Policies.* If the amount of the insurance of the insuring company, issued at the time the reinsurance was obtained or prior thereto, is cancelled or reduced in amount, the cancellation or reduction to apply on the initial amount of the reinsurance. If there are several companies who have reinsured a given risk, the reduction in the reinsurance to be made pro rata.

8. *Extended Insurance.* If the policy of the insuring company lapses and extended insurance be granted, the insuring company to immediately notify the reinsuring company, returning the original certificate, the reinsuring company to issue a new certificate for its proportion. The new certificate to show the Yearly Increasing reinsurance due to the fact that the reserve on the amount reinsured then decreases each year instead of increases. The amount of such Increasing reinsurance must not in any case exceed the amount of the original initial reinsurance. The insuring company can either pay for this Extended Term reinsurance certificate in one sum or continue to pay a Yearly Renewable Term premium.

9. *Death Claims.* In the settlement of death claims, the reinsuring company follows the insuring company in settling, and the insuring company has the sole right to decide whether a claim shall be paid or contested. If a claim is contested, the actual cost of defending such claim to be borne proportionately. In case the contest is successful, the reinsuring company shares pro rata in any reduction. If in a given case the reinsuring company has accepted an amount largely in excess of that retained by the insuring company, special provision should be made whereby the insuring company will submit copies of their claim papers to the reinsuring company and receive the approval of the reinsuring company before paying the claim.

10. *Changes in Policy—Extra Premiums.* If any change is made in the conditions of any policy upon which reinsurance is carried, the insuring company must immediately notify the reinsuring company and pay to it a pro rata (based on the initial reinsurance) of any extra premium which may be charged in connection with the change in the policy conditions.

11. *Right to Inspect.* The reinsuring company at all reasonable times to have the right to inspect at the office of the insuring company any books and documents referring to risks reinsured.

12. *Continuation of Reinsurances.* The reinsurances granted to be maintained in force by both parties as long as the insurance of the insuring company issued at the time the reinsurance was granted or prior thereto remains in force.

13. *Facultative Reinsurance.* If the insuring company desires reinsurance for an amount larger than that which it can automatically cede, application can be made on the Facultative basis for the excess, the reinsuring company to notify the insuring company within a certain stated period after receipt of the papers whether or not it will accept the additional reinsurance.

14. *Refund of Premium Taxes.* The reinsuring company to refund to the insuring company the tax paid by the insuring company on reinsurance premiums paid to the reinsuring company, provided that the reinsuring company does not have to pay a tax on such reinsurance premiums.

15. *Arbitration of Disputes.* Any disputes or differences between the two companies upon which an amicable understanding cannot be arrived at, should be decided by arbitration. The usual method is for each company to appoint an arbitrator, and these

two to select a third. If the two arbitrators appointed by the companies cannot agree upon the choice of the third, then the appointment of the third to be left to a designated official, such as the Manager of the Association of Life Insurance Presidents, or the President of the American Life Convention.

16. *Increase in Retention of Insuring Company.* It is sometimes provided that if the insuring company increases its maximum retention, then all the old reinsurances in force must be reduced by such an amount as will bring the retention of the insuring company up to its new maximum retention. If a number of companies have granted reinsurance on a risk, then the reduction in each company's reinsurance to be that proportion of the total reinsurance to be cancelled or reduced, as the amount of the reinsurance of each company bears to the total reinsurance.

17. *Cancellation.* The agreement as to new reinsurances can be cancelled by either party by giving the other ninety days' notice of cancellation in writing.

In the case of a Facultative reinsurance agreement on the Yearly Renewable Term plan, the same general form is followed, except that the insuring company has to apply to the reinsuring company for each case where it desires reinsurance or where it desires to revive lapsed reinsurance, and the reinsuring company is entirely free to accept or reject.

For a reinsurance agreement on the Coinsurance plan either Automatic or Facultative, a number of changes must be made in the foregoing outline for an agreement on the Yearly Renewable Term plan. The principal differences are due to the fact that under a Coinsurance agreement, the reinsuring company exactly duplicates the coverage of the insuring company, and in case of reduction or surrender of the insuring company's policy, the reinsuring company allows a pro rata of any surrender value granted by the insuring company. A complication arises, however, if Extended Insurance is taken and the insuring company's policy has a loan outstanding and possible dividend additions, in which case the Extended Insurance should be for the same term as that granted by the insuring company and for an amount which shall be in the same proportion to the amount of the insuring company's policy (inclusive of dividend additions and less the loan) as the reinsurance bears to the original amount of the insuring company's policy. Any excess of cash value of the reinsurance on account of the insuring company

having made a loan, is to be paid to the insuring company, and any deficiency (because of dividend additions to the insuring company's policy) to be paid to the reinsuring company by the insuring company.

In case reinsurance of Disability Benefits or Double Indemnity is desired in connection with a Yearly Renewable Term agreement, it is necessary that adequate premiums should be charged by the reinsuring company, as it has not the other sources of profits, which the insuring company has. If the insuring company finds that the premiums which it has been charging for Disability Benefits or Double Indemnity are insufficient for the benefits granted, it can recoup by charging the loss against the loading margin of the policy or the excess interest. These sources are not open to the reinsuring company.

The question is often raised as to the probable mortality on reinsured risks. It is, of course, true that these large risks will not show as favorable a mortality as the smaller risks. There is a good reason for believing, however, that during the last two or three years a much better class of risks has taken large policies than formerly, being influenced by the drop in the value of the dollar, inheritance taxes, and also by what is known as business insurance. It is, therefore, reasonable to believe that the mortality on these large risks will not in the future be so much higher than the average, as has been the case in the past.

In conclusion, a word may be advisable as to the insurance laws of the various States in relation to reinsurance agreements: The insurance codes of the States are all designed to protect the policyholder in his relations with the insurance company, as he is not supposed to be versed in insurance and competent to fully look after his own interest. Insuring companies, on the other hand, are entirely able to look after their own interests, and therefore, the insurance laws do not generally apply to a reinsurance agreement.

Discussion of Preceding Papers on "Life Reinsurance" and "Reinsurance."

(WRITTEN DISCUSSION.)

MR. M. W. TORREY:

The joint paper of Messrs. Bagley and Laird, and the paper of the speaker, cover very much the same ground, and there is, therefore, very little I can say in the way of discussion. The principal difference is that the first named paper being double barrelled, goes more into detail.

With reference to what Messrs. Bagley and Laird say as to "Influence of Retention," I agree as a whole. I do not, however, think that you can broadly classify a large risk, from the mortality point of view, as "a policy in excess of the Company's limit," for there are a considerable number of small and conservative companies that only retain from $5,000 to $10,000, and which operate in sections of the country where a policy of from $10,000 to $25,000 cannot be considered as a large policy. The size of the Company's retention is unquestionably a modifying factor.

Taking up now the question of participation in the Mortality Savings under a Yearly Renewable Term Agreement, I think that the participation in such savings should only be granted where the insuring company has to cede its first surplus to the reinsuring company, and should not be granted in connection with Facultative Agreements, where the reinsuring company does not regularly receive the insuring company's first surplus, and only occasional cases are submitted for reinsurance.

Where reinsurance of Disability Benefits or Double Indemnity is involved in connection with a Yearly Renewable Term Agreement, I would like to emphasize what I stated in my paper as to the importance of the extra premium being adequate for the Disability Benefit or Double Indemnity reinsurance granted. The reinsuring company has not open to it the other sources of profit which the insuring company can draw upon, and, therefore, must charge an adequate rate. If the insuring company finds that its extra premium is insufficient, it can draw on the loading margin or the excess interest which the reinsuring company under a Yearly Renewable Term Agreement cannot do.

Messrs. Bagley and Laird, in treating of the handling of Disability Benefits, favor the "Interest Method" where instalments are involved. I think that the straight Instalment method is the best, as it is more easily understood, and it should be borne in mind that in handling reinsurance, we are not always dealing with Actuaries, and it is difficult for one who is not an Actuary to

understand and appreciate that the two methods are mathematically the same.

There is another matter referred to in both of the papers that I would like to emphasize, and that is the advantage to a new company of having an older and more experienced medical and underwriting department pass on its large risks. One of the troubles in a new company is that its medical director is often not an experienced life insurance man. He may be a first-class doctor, but has not had the necessary life insurance experience to fully realize that in looking at a risk you must do so from the group standpoint and not from the point of view of the individual medical practitioner. I have run across a number of medical directors who are very prone to look at a risk from their individual medical practice point of view and say: "Oh, I had a man like that in my practice, and I think he is a good risk. He lived so many years." Well, that one man may have, but ten thousand men with the same impairment he had would not live the same number of years as ten thousand standard risks.

MR. WENDELL M. STRONG:

These papers cover so completely and so satisfactorily the general subject of reinsurance that it is difficult even for one interested in the subject to know how to discuss them. I shall therefore content myself with calling attention to a few points of interest.

I have not noticed that either of the papers mention a form of reinsurance generally used in Great Britain, namely, reinsuring by guaranteeing a specific policy or policies. Thus if policy No. 1,000,000 is the policy reinsured then the reinsurance can be kept in force so long as this particular policy remains in force, even though the other policies on the life are discontinued and the total amount insured by the original company very greatly reduced. On the other hand it is not obligatory for the ceding company to retain the reinsurance in force but it can be discontinued by the ceding company at any time.

It would appear that these papers were written having in mind a small company as the ceding company. The ceding company is not always a small company since large companies also reinsure and the problems which are met probably increase with the size of the company since a large company is more apt to have a number of policies on the same life than a smaller company and the reinsurance is greatly complicated when there are policies on the same life issued at different times. It is suggested that the way to deal with cases where there are policies issued at different times on the life of an insured is that in the case of the termination of any former insurance the reinsurance shall be reduced in the same amount, but if later insurance is terminated the reinsurance shall not be affected. This seems to me an unsatisfactory method. All

reinsurance should be reduced, whether the insurance terminating is earlier or later than the date of the reinsurance. This would enable a company to have reinsurance agreements with different companies which would always be consistent in regard to the effect of termination of original insurance, such effect being to reduce the total reinsurance by the same amount as the termination and such reduction to be divided prorata among all of the companies reinsuring the risk.

One or two problems may be of interest. A Joint Life policy is applied for of an amount requiring reinsurance. The original company has $5,000 old insurance on life "A" and $15,000 on life "B." Which amount should be taken as determining the limit of the amount which the original company should hold at its own risk? I think it would be reasonable to consider the $15,000 as the amount determining how much of the joint policy should be kept at the original company's risk.

Again, suppose the $5,000 on the life of "A" is terminated, the insurance on the life of "B" being unchanged. Should the reinsurance be automatically reduced?

Let us suppose insurance of $50,000 issued in 1914, $100.000 issued in 1917, and $150,000, all reinsured, issued in 1922. The $50,000 issued in 1914 lapses and goes to extended insurance. Is the reinsurance affected thereby? I should hold that the reinsurance would not under the usual terms of reinsurance agreements be affected thereby but would continue until the extended insurance terminated, at which time the reinsurance would either terminate or would decrease by the same amount.

Suppose the policy issued at the time the reinsurance is obtained, and which is the cause of the reinsurance, goes to extended insurance and at the time it goes to extended insurance it has both dividend additions and a loan. The dividend additions would prolong the term of the extended insurance and also increase the amount, whereas the loan would both shorten the time and decrease the amount, and almost certainly neither the term nor the amount would correspond with the amount or term under the reinsurance if the transaction were treated as a lapse of the reinsurance. In such case the reinsurance should follow the original insurance giving extended insurance to the same term and of the same pro rata amount and the difference should be adjusted by cash payment.

(ORAL DISCUSSION.)

MR. M. M. DAWSON:

Mr. President, I am heartily glad these two papers have been presented. The subject has been little understood and not infrequently misunderstood. There are very few papers upon it in all the actuarial literature of all countries. The work done and

condensed in these two papers is of a very high order, and cannot fail to be useful to all who are interested in a practical way.

I fancy the largest of our American companies had European contracts for excess line reinsurance before the time I am about to name, but I think the first treaty made by one of the smaller companies was one I negotiated through the London office of the Munich about twenty-five years ago. It was automatic, on a one-year term insurance basis and proved satisfactory to both companies. I had to hew it out in the rough; there were no precedents here to follow. Such companies here had theretofore obtained reinsurance on individual policies by applying, as regards each, separately—usually on the ten-year term basis.

One feature should be called to your attention, viz., that when there is a treaty covering automatically, unless it is based upon something more than ordinary confidence, there should be a special exception of cases where the company seeking reinsurance has already its full line or nearly so and is now taking on a lot more insurance, all or nearly all of which is to be reinsured. Very obviously there is not the same incentive to examine that risk carefully and pass upon it as there would be if the original insurer were taking on the entire risk at one time.

Concerning facultative reinsurance, although one of my clients did a very extensive business in that line, I always much doubted its wisdom. I would particularly warn companies which take reinsurance in that form, that they should not permit, in the absence of the policy having been lapsed or cancelled in the original company, a further facultation, namely, carrying some policies and dropping others at the option of the company reinsured. A very grave damage can be done the reinsuring company by this adverse selection.

MR. M. W. TORREY:

I should like to answer Mr. Dawson there. As far as I know, the facultative agreements as well as the automatic, provide that the insuring company must keep up the reinsurance as long as the original insurance is kept up. The insuring company is not allowed any selection at all.

MR. M. M. DAWSON:

I was merely making the point that it should be provided against. I am sure it is in companies that are engaged purely in reinsurance, but it is not always done when the company is not purely a reinsurance company; and I am therefore calling attention to it.

MR. W. A. P. WOOD:

Both of the papers in connection with re-insurance are excellent and deal with the question in detail. Perhaps what I may have to

say will not be in the nature of a discussion of these papers, but there are one or two points which I would like to make in regard to this subject.

The company with which I am connected, together with a number of other Canadian companies, has been doing re-insuring business on the Co-insurance Facultative plan for a good many years, perhaps 25 or more. As a result of the giving and accepting of re-insurance during these years we have a pretty fair understanding of the underwriting principles of these other companies. It is very desirable, even in the Facultative form of re-insurance, that the re-insuring company should have confidence in the underwriting methods and in the selection of risks employed by the principal company. If the re-insurance is on the Automatic plan I think the desirability for complete confidence is increased. I know that a medical director frequently wants to know on what basis the medical director of another company considers the risks, and he also wants to have some idea of the class of examiners of the other company; that is, he wants to get some understanding with regard to the underwriting of the principal company. If, therefore, the medical directors are well acquainted with each other's work, and if the actuaries are also well known to each other, I think the work of re-insurance is considerably simplified.

By using the Co-insurance plan, generally speaking the results of any less rigid selection by the principal company may to some extent be overcome, because the re-insuring company is using the premiums, dividends, etc., of the principal company. If, therefore, the selecting by the principal company is not in general quite so rigid as in the re-insuring company, then no doubt the fact will be shown by the lower dividend scale which the former company will have.

The Facultative method has the disadvantage of not enabling the principal company to issue the larger amount of insurance immediately, and this is a drawback, especially if the principal and the re-insuring companies are separated by some considerable distance.

In one of the papers it has been stated that the mortality experienced on these larger risks is considerably higher than for the smaller risks. I might say, however, that the mortality experience covering a period of 15 years on policies issued by the company with which I am connected and re-insured with other companies has been at least 20% more favorable than on the total business of the company. I believe, however, that there has been some special reason for this, as there is no doubt but that the mortality experienced on large risks generally has been less favorable than on small risks.

MR. HENRY MOIR:

Mr. President, I am much struck by the fact that a subject like this, which eighteen or twenty years ago had almost no interest for the Society, has now produced two papers which, as Mr. Strong said, cover the ground so completely. I might point out one other little problem in addition to those Mr. Strong mentioned. Under an automatic arrangement the amount at risk of the reinsuring company—that is, the ceding company as it is called—is frequently fixed by the net amount of risk. Now, in the event that there is in force a policy with a large reserve and that policy afterwards goes to extended insurance, of course the ceding company may find itself with a larger amount at risk than its normal limit. That, unfortunately, is a condition which arises out of the unscientific nature of extended insurance, and we cannot very well avoid it, because the reserve decreases while the risk remains the same on the extended portion.

The remarks in regard to complete confidence, as between the ceding and the reinsuring company, are particularly applicable. The minds of the two parties to a reinsurance contract should meet absolutely and with complete confidence. The greatest reinsurance man that this country has seen was a stickler for that one point. If he found the slightest evidence that one of the companies with which he was dealing was taking advantage of him—it didn't need to be dishonest, simply taking a doubtful legal advantage—his immediate reaction was: "Let's cancel the contract." That is the fundamental basis on which reinsurance under the co-insurance plan should stand.

Mr. Dawson covered the point of the avalanche of insurance on one risk, which may come to a company with a good many contracts outstanding. There must be some back door out of which the excess insurance thus thrust upon the reinsuring company can be quietly disposed of. At the present time I presume the chief back door is Europe in the form of term insurance in one shape or another. Otherwise, even the large companies would occasionally find a risk on their books for an amount they would not care to contemplate.

We can congratulate the authors of these papers on the completeness with which they have covered the subject.

MR. C. D. RUTHERFORD:

There are two points that occur to me. One point that Mr. Torrey has laid some stress on is the fact that a small company with its selection handled largely by its medical director would be better for advice from a large and well managed company. That is very true, but, unfortunately a company in such a position is very liable to listen to no advice whatever. It prefers not to take advice from a larger company, looking on such advice as being

merely an attempt to regulate its business by another concern. That is particularly the case with Facultative contracts.

The other point is that in one of the papers—I think Messrs. Bagley and Laird's paper—the suggestion is made that ceding reinsurance fairly liberally allows the agency to write a large volume of business at no increase in expense practically. That is subject to some modification. The head office overhead in connection with reinsurance is only too frequently overlooked. That applies, I may say, both to companies taking reinsurance and companies giving off reinsurance. In Canada in the past the tendency has been for a company accepting reinsurance to keep it amongst its ordinary business, to give no special attention to it, and consequently, the special expenses of attending to the different guarantees and the different profit bases have been more or less overlooked. A company giving off reinsurance, of course, has to keep that specially by itself, but even there the expenses are not usually segregated, and I think will be found to be heavier than is usually anticipated.

There is one other point, and that is, under the standard agreement of the Canadian Life Officers' Association, which is followed by most of the Canadian companies, it is perfectly possible for one of the companies, for any reason whatsoever, to deliberately select out its reinsurance by inspecting it and cancelling the better risks. There is no requirement in that agreement that the reinsurance shall be carried while the original insurance remains in force. I must say that I consider that a very dangerous provision indeed.

Expense Investigations and Some Other Statistical Problems Dependent Thereon.

BY

JAMES S. ELSTON.

During the first fifteen years of this Society's existence the subject of Expenses was a frequent and lively topic of discussion. Many papers discussing it appear in the *Transactions* at that time. But it has been many years now since it has been discussed except either incidentally to other subjects or specifically in a particular phase as, for instance, in the question of legal limitation of expenses. There is little of value to help the student in some phases of such an important subject. It is my hope, therefore, that a paper now may bring out enough discussion to give a more comprehensive view of the whole subject.

Furthermore, a consideration of expenses appears to be particularly timely because we may now be entering a period of higher expense rates which should be given the best thought of the profession. It is recognized that there is a lag between the wage and price curves both when prices are rising and when falling. Many in salaried positions found the lag in salaries greater than in wages when prices rose, and it is to be expected that an analogous lag will occur now during the falling of prices. During the past few years we have had almost unbearable expenses due to abnormal wages, salaries, taxes, rent, supplies, etc. But there was considerable compensation for these in the immense amount of new business produced. The rise in the expense rate was not so great as the immense expenses would alone indicate because new business was produced so easily. From this viewpoint overhead expense was cut per unit of insurance. Now, however, even though the total expenses may appear to be coming down, the lag in expenses, particularly in salaries, becomes operative, increasing the comparative overhead and producing a particularly difficult problem because the new business produced last year was considerably reduced, and probably will not soon be comparatively as great as in the years immediately preceding.

Time has not permitted the writer to investigate many of the phases of expenses because they intimately involve many of the actuary's most perplexing problems, but as all these problems are interrelated, a brief survey of the papers covering the other subjects may be helpful. First there is the fundamental accounting problem of classification of expenses among the various disbursement items of the annual statement. The diversity in practice between companies in this respect has been deplored by Mr. H. Pierson Hammond in "Annual Statements of Insurance Companies" in Dunham's "Business of Insurance," Vol. III, page 38, and by Mr. Joseph H. Woodward in "Annual Statements of Insurance Companies" in Vol. VI, No. 2, page 13, of the *Proceedings of the Insurance Institute of Hartford.* The latter calls attention to the two mutually contradictory ideas underlying the classification, "first, that the item of expense should be classified according to the general *purposes* for which it is expended; and second, that it should be classified according to the specific *thing* for which the money is paid." One attempt at greater uniformity is somewhat discussed by Mr. Lawrence M. Cathles and others in "The Proposed New Disbursement Blank" in Vol. IV, No. 2, page 41, of the *Record of the American Institute of Actuaries.* Mr. Ray D. Murphy in "Life Insurance Bookkeeping and Annual Statements" in Vol. XV, page 328, of our *Transactions* sets forth some of the most general principles to be observed. Various English articles likewise cover some phases of the problem from their statement viewpoint.

There is also the problem of "Limitation of Expenses" discussed in Vol. III, page 108, of the *Record,* partly from the legal viewpoint because of the New York and Wisconsin limitation laws but principally from the practical side which involves the most general questions of company expansion. In "Premium Loadings and Expense Limitations" in Vol. XVI, page 272, of the *Transactions,* Mr. E. E. Rhodes discusses the limitation of expenses of participating companies within the loading.

The heavy first year expenses as compared with the renewal are the cause of the most difficult problems in reserve valuation, leading to all the various modifications of the net level premium valuation that give results comparable to the modified preliminary term valuation. In this case the expense problem is so much a part of the valuation question, a distinct subject, that

the various references, English and American, are not given here.

The other principal question, in which expenses play a leading rôle, is that of surplus distribution. Papers dealing with this are referred to not because the problem is to be discussed here but because (1) practically every paper in the *Transactions* dealing with expenses is written from the surplus distribution standpoint and (2) various sections of these papers are suggestive of the other phases of the expense problem. These papers start in the *Transactions* with that of Mr. William E. Starr in Vol. I, No. 3, page 24, on "The Just Apportionment of the Expenses of Mutual Life Insurance Companies" which is little more than a suggestion to separate insurance expenses from investment expenses (trust fund expenses). They range from such a simple division to the elaborate analysis of Mr. Percy C. H. Papps in Vol. IX, page 232, in "A Few Suggestions as to the Assessment of Expenses" where he divides them not only among Investment, Death Claim and other Expenses, the latter subdivided among New, Renewal and Total business, but he also gives a very elaborate system of assessing the first year expenses as a percentage of the premium, varying with the form and age. It is interesting to note that this latest paper, devoted solely to the expense problem in surplus distribution, recommends the determination of general renewal expense as a flat sum per thousand insurance, the method implied in the present paper for non-participating insurance.

There has been at least variety in the suggestions as to the best basis for allocating expense. Elizur Wright at first recommended such apportionment as proportional to the "insurance value," a discounted present value of future costs of insurance. Various actuaries have recommended assessing other than investment expense in proportion to the current cost of insurance, including Mr. Walter C. Wright in Vol. I, No. 4, page 33, in "On the Provision for and Assessment of Life Insurance Expenses, etc.," Mr. William E. Starr in Vol. III, page 171, in "The Apportionment of Expenses and its Relation to the Distribution of Surplus" and Mr. Daniel H. Wells in Vol. II, page 361, in "Application of the Contribution Plan to the Distribution of Surplus with Special Reference to the Best Method of Assessing Expenses and Determining Premiums and Reserves."

The latter considers the average cost, including commission, of new business other than term as probably over $30.00 per $1,000 and the renewal expense other than investment as under $3.00 per $1,000. Mr. Sheppard Homans in the *Transactions,* Vol. I, No. 4, page 30, in "Some Thoughts Regarding Margins for Expenses and Contingencies and Surrender Charges" would assess expenses partly as a constant per thousand insurance and partly proportional to the term premium for the duration of the policy, even on endowments.

In a discussion of Mr. James Buchanan's paper on "The Influence of Expenses and Selection on Reserves for recently effected Policies" in the *Transactions of the Faculty of Actuaries,* Vol. II, page 195, it is suggested that expenses of management of paid-up policies be allowed for in determining profit or dividends by a reduction in the rate of interest assumed. This paper itself fairly well summarizes the English discussion of the assessment of expenses which is usually based on assuming a constant percentage (as Dr. Sprague's 7½ per cent.) of the renewal premiums as covering the expenses applicable to the management of existing business and charging the remainder of the expenses either against the amount of new business or usually against the first year premiums.

In "A Suggestion as to the Distribution of Deferred Dividend Surplus" in Vol. VII, page 315, of the *Transactions* Mr. Percy C. H. Papps suggests apportioning some expenses according to the cost of insurance, and the balance, aside from the investment, in proportion to the premiums.

Arising first at the time of the above papers but reaching development later is the theme of allocating expenses as they are actually incurred instead of the way they might possibly have been incurred if life insurance had developed entirely along theoretical lines. In "Distribution of Expenses in Life Insurance" in Vol. II, page 150, Mr. William D. Whiting suggests a division among Investment, Mortality and Premium expenses, in which the most interesting points to be noted are that "the expense of getting the new business (including medical fees) which occasions the low mortality, less surrender and lapse gains, is clearly a debit against mortality" and that "A fixed charge of $4 per $1,000 insurance seemed, on the whole, least objectionable" "in determining the permanent normal cost of

taking care of running policies,''—this $4 to be taken out of premium margins. Mr. William D. Whiting in Vol. V, page 214, in ''Provision for and Distribution of Expenses'' considers New Business, Collection, Settlement, Investment and General Expenses, the latter, say, $1 per $1,000 of insurance annually to be provided in dividend calculations by using the Combined Experience mortality table cost of insurance which is said to slightly increase but average about $1 per $1,000 of insurance greater than a true q_x would produce.

As intimated above this outline is given as merely suggestive and not exhaustive of the papers dealing with expense problems in surplus distribution which are analogous to one phase of expense analysis covered herein, that is determining the incidence and amount of expense for calculating and later checking non-participating premiums along the lines gradually developed by various companies and described by Mr. E. E. Cammack in Vol. XX, page 379, on ''Premiums for Non-Participating Life Insurances.'' The present paper in its broader aspects is somewhat along the lines of that of Mr. E. B. Morris in Vol. IX, page 37, of the *Record* in ''Some Suggestions Affecting the Financial Statements of Life Insurance Companies.''

The present remarks may be considered from a threefold aspect:

(1) A general discussion of the separation of the Life expenses from the Casualty;

(2) The desirability of developing separate funds for the various classes of Life business transacted, involving, of course, a separation of expenses;

(3) Some suggestions and questions as to a standard by which to judge whether the expense rate is low or too high.

Analysis of Expenses.

Separation of Life from Casualty Expenses.

Before we can establish any standard of expense to determine whether expenses are low or too high and before we can complete many other investigations, it will be necessary to obtain the actual expense facts. Of course, expenses are analyzed in the annual statement, but the actuary is fortunate (at least in the amount of work involved) if the problem is not much more

complicated. In the first place there seems no doubt but that wherever possible expenses should be used on an incurred basis with proper allowance for expenses unpaid at the beginning and end of the year. Of course, the corresponding premiums should be on the same basis. Further, in comparing a company's statements one year with another, care must be taken that there is no change in method. For instance, in working the table at the end of this paper it was found that, in one year covered, one of the companies put up a certain $150,000 tax liability for the first time, thus practically doubling that particular incurred tax for that year as compared with both the preceding and the subsequent years which were consistent with each other. Of course, allowance was made for this condition, especially because this tax item was an appreciable part of the total expenses.

Many companies issue Industrial, Group, Wholesale and Reinsurance business. Most issue Life Annuities, and more and more are issuing Accident and Health business. Others issue, or at least have in force, both Participating and Non-Participating business. The complications involved can be appreciated only by those who have had experience with them.

A generalized discussion from the standpoint of a mutiple line company may be the most satisfactory way of attacking these problems as it is easier to pass from a generalization to a particular case than to generalize. The first problem to be considered will, therefore, be how to correctly apportion expense between the Life and the Casualty lines of which Accident and Health are of most general interest to this society.

As the subject of cost accounting is covered in Mr. Claude E. Scattergood's article on "Cost Accounting in Casualty Insurance" in Vol. II, page 253, of the *Proceedings of the Casualty Actuarial Society,* attention will be called to only some of the most important considerations. In the first place the term "cost accounting" need not itself raise unnecessary barriers. Without "cost accounting" you can have, and companies do have, systems of at least very satisfactorily apportioning their expenses.

Separate ledgers should be kept for the different classes of business unless the amount transacted in any line is so small

that the figures desired for a final analysis may be more easily obtained from memorandum accounts.

Of course, the first principle to be observed is to directly apportion all expense items that can be directly without too great expense. This generally includes medical and inspection fees, most taxes and most of the home office salaries. Some items as commissions, legal expenses and loss expenses should be separated even if the expense of doing so is high, just as premiums and claims should be accurately determined. This is essential because they are the fundamental items in each line of business.

Resort may be had to various devices to help keep the analysis correct—for instance, different colored salary checks may be used for different departments. Home office traveling expenses may be apportioned to the same department as the salary of the person traveling. In the case of the higher officials a division of salary is necessary, based best, it would seem to me, on the individual's estimate of the best ratio of division. Rent may be figured very accurately on the basis of actual space occupied and apportionment factors used for a whole year unless unequal growth and rearrangement of departments make a change in the factors advisable.

The various other expenses except the investment can be apportioned in different ways. Some, like postage, telegraph, telephone and express, it may be possible to charge directly. One troublesome item is furniture and fixtures, because there is likely to be so much transfer between departments. An apportionment of this and items like heat, light and maintenance of offices, etc., may be made according to rent (assuming the latter carefully figured) with more reason than at first appears. Of course, the space in the different departments occupied by clerks' desks and stenographers' typewriters is in general proportional to the rent. But more expensive furniture for an officer as well as special furniture or machines occupy additional space somewhat comparable with their greater value. It should be borne in mind, however, that as such items must be charged off in the annual statement as expense in the year of purchase, their assignment should be rather according to the rate of expansion, that is proportionate to the increase in rent rather than to rent itself. If there is considerable inequality between depart-

ments in the amount of work done on sorting and tabulating machines, they ought to be treated separately.

Again the main fact to be borne in mind is not to make such a great subdivision of these miscellaneous expenses that the accounting expense itself becomes prohibitive. Of course, the latter may in many cases be materially reduced by making the original entries without apportionment and making the proper division of expense and consequent adjustment entries once for all at the end of each month, applying the factors to the month's appropriate totals.

Another great saving may be effected by dividing the comparatively small but troublesome residue of expenses not otherwise assigned in the same proportion as the assigned expenses, if no better method suggests itself.

The most consoling fact to one inclined to be too conscientious is the small comparative error in the total, if the apportionment of small expense items, as for instance advertising, is not on the best basis possible. It is surprising what a small proportionate error in the Life expenses is made even if a known error in the individual item is used. And, of course, if the work is done as freely as possible from bias, there is at least the hope that errors in one direction will be counterbalanced by errors in the opposite direction, particularly where the methods used are the consensus of opinion (probably a compromise) of several individuals.

If the company is on the branch office system the problems are immensely more complicated, not only because there is a great amount of additional expense to be analyzed by the company instead of left to general agents, and because this expense is incurred all over the company's territory, but because, due to the smaller branch units, more of the individual employees' salaries, etc., will have to be divided between departments. Whether these expenses are paid directly from the home office or from the branch, the same principles will govern as in the case of the home office. Besides, greater assurance can be placed in the results, as, for instance, in the division of branch office salaries, because of the great number of men necessarily taking part in the estimates, some naturally charging too much to the Life department and some too little. In the larger cities practically separate organizations for the Life and Casualty insur-

ance may be maintained, thus materially reducing the percentage error in the final results.

The one error in all such apportionment of expenses to be guarded against is any division according to the premium income. I know of no method so likely to be suggested or so likely to be wrong. "What is the ratio of expense to premium income?" is too often likely to be the question asked. This is sometimes necessary in the casualty lines, though even there it is not usually equitable as among the different lines. With caution it might possibly be applied to some phases of the Group one-year term business. But to anyone with a thorough understanding of Life insurance, it must be obvious that it is not applicable where the investment feature of Life insurance is included. The expenses of Endowment and Term policies are not similar functions of their premiums. Herein lies much of the difficulty in accounting for insurance expenses.

Considerable thought has been put into developing a substitute for premium income as a basis of comparison between departments. Some expenses might be divided according to the actual number of policies handled. This takes account of the frequent change in contracts in the Casualty lines. One suggestion is that the apportionment of some expenses as well as their subsequent comparison between departments be on the basis of loading of gross premiums over net, using as net premiums in the Life business the true cost of insurance including the necessary saving for investment. That is, the net premiums should be calculated on a mortality table that closely reflects the actual mortality experience and at a correspondingly true interest rate. Another possibility is to approximately divide premiums between the portion necessary for present claims and expenses and the portion to be invested to take care of future claims. Expenses could then be apportioned according to premiums weighted to overcome the principal difficulty due to their different nature.

Investment expenses should be separately considered, as has been done by most writers. If investments are kept as much as possible divided so that all of one kind are in one department, some of the work is simplified. For instance, all the real estate, mortgage loans and policy loans with all their attendant expenses may be carried in the Life department and all the col-

lateral loans in the Casualty department. Stocks and bonds and bank balances will necessarily be carried in both departments.

The increasing importance of the Disability and Double Indemnity provisions in life insurance suggests the growing importance of separately assessing the expenses in connection therewith. These coverages are analogous to the Accident and Health insurance, but it is sufficiently accurate to apportion the expense as a percentage of the premium.

Insurance Funds.

After the Life expenses are separated so they can be used, for instance, in the annual statement, the next stage in their analysis is among the different kinds of insurance—Regular, Industrial, Wholesale, Group, Reinsurance and Life Annuities. For each class a "fund" should be developed showing the net total amount of assets and surplus that that class has contributed towards the company's position as a whole. Mortality and other investigations throw considerable light on the experience but they tell only part of the story. The only record really satisfactory is a fund. This does not imply that any special assets need be earmarked as belonging to any fund, for, as will appear later, this is entirely unnecessary. A Participating fund should be developed separately from the Non-Participating and possibly a separate Substandard fund should be maintained. Some companies may have Deferred Dividend funds.

In general the same principles followed in separating the Life from the Casualty business will be applicable to these subdivisions of the Life. These funds are best developed as miniature annual statements showing the amount of ledger assets carried forward from previous years, the income and disbursements for the year and the assets and liabilities at the end of the year. The most satisfactory way to secure the required division of expenses as well as premiums, claims, etc., is in this case also from ledger accounts. The expenses directly chargeable to each of the lines desired can be kept separately on the books. Again many of the expenses need be apportioned once a month only. If necessary, some other expenses like overhead

can in this case even be adjusted after the books are closed, because making up these statements for home office use would not involve any change in the regular complete Life statement to be submitted to insurance departments and to be published to show the condition of the Life business as a whole.

As intimated above investment expenses need not be separately considered as it seems much better (unless the circumstances be very peculiar as possibly in some cases for a legal division between Participating and Non-Participating business) to deduct the total investment expenses from the total investment income, compute the net interest earned rate either by Zartman's formula or preferably by the following modification:

Interest Rate =

$$\frac{12\,I}{\sum_{n=0}^{n=12} B_n - \frac{1}{2}(B_0+B_{12}) - 6\,I},$$

where I is the net incurred interest and B_n is the proper amount of invested assets at the end of the nth month. This takes into account the mean invested assets of each month and is, therefore, much more satisfactory on investments that fluctuate considerably, like collateral loans and bank balances. According to the original formula, a very low bank balance at the end of any year would produce an inaccurate interest rate on the cash in banks. Of course, the two formulas give very nearly the same results on the large classes of investments that fluctuate little as well as on the investments as a whole.

Then in the case of each "fund" under investigation this net interest rate may be applied for the whole year to the amount of the fund at the beginning of the year, and for half a year on the average to the excess of the income over disbursements. Even a negative fund or a negative net income should be used where necessary until the business gets on its feet, as this method helps give a truer index of when the particular class of business becomes really self-supporting. Many classes of business when first started are like new companies that need to borrow in the early years, possibly from a paid-in surplus. Excess of disbursements over income in new lines will probably never again be as great as it was during the influenza epidemic.

From the above information Gain and Loss Exhibits are easily developed, especially if the total increase in reserve in the Life department has been worked as a tabular summary of the development of the reserve in each of the special classes of business. Indeed perhaps the best method of obtaining a Gain and Loss Exhibit is to (1) account (through net premiums, interest, loss to restorations, reserve increased by the various changes and restorations, mortality cost and the reserve released by the various methods of termination) for the increase in the reserve in the various classes of business separately and hence in toto, (2) develop the Gain and Loss from the various Income, Disbursement, Asset and Liability items using the net increase in reserve as one of the factors and (3) substitute for the latter the dozen or so items obtained in (1) such that when combined in the proper way they account for the increase in reserve. In this way the danger of a clerk leaving out some new class of item or some items like "Consideration for supplementary contracts involving life contingencies" or of misusing it, is eliminated. An exact balancing for each of sections (1) and (2) is obtained because there is no excuse that, if a balance is not struck, such a condition is probable because a "Balance unaccounted for" is to be expected. From this viewpoint the "Balance unaccounted for" resolves itself into a "Balance not otherwise accounted for" made up of the items for which particular provision is not otherwise made in the statement. Such a subdivision of the work is particularly important if the "Interest required to maintain Reserve" or the "Expected Mortality on net amount at risk" is obtained as a balancing item as this eliminates the possibility of using such an item as "Consideration for supplementary contracts involving life contigencies" as a deduction from the Interest or as an increase in the Expected Mortality. Of course, these same principles apply to the development of the Gain and Loss on any of the classes of the Life business.

Even without the Gain and Loss Exhibit considerable information is disclosed by such investigations as to the types of business that produce gains and those that produce losses and decision can be reached for instance as to whether to continue writing an unprofitable line on the same basis as in the past or take steps to correct conditions. Some writers have argued

against making such subdivisions, a few even deploring the necessity of making a division between Participating and Non-Participating business, but it seems to me poor business policy for a Non-Participating company not to take steps to find out which classes of business produce gains and which losses. It is inequitable unless a Participating company so adjusts its dividends. What Mr. E. E. Rhodes has said in a slightly different connection applies equally as between classes of business: "It would seem to be a cardinal principle of mutual insurance that the rate for any particular form of policy should be sufficient for the following purposes: 1st, to meet all the policy obligations; 2d, to meet the necessary administrative expenses; 3d, to enable the company to maintain an adequate contingency reserve; and 4th, to maintain the agency organization, all on the assumption that *no other form of policy is issued by the company.*"

It must be borne in mind that statements of the "funds" on the basis described involve the weaknesses of the Annual Statement itself. For instance, in the case of Wholesale insurance the statement loss will be too great if a level premium valuation is made. In the case of Group term insurance there is a slightly too great reserve because approximately half of the premium is taken as the reserve, though all the commissions have already been paid, leaving still to be made less than half of the disbursements for which the premium was designed. In case of Life Annuities the reserve is calculated on a lower interest basis than is necessary because the bulk of these reserves is already invested at higher interest rates and will be comparatively slightly affected even if interest rates decline.

Interpretation of Expense Facts.

Standards of Expense in General Use.

Assuming the expense facts to have been determined, what do they mean? Are the expenses higher than they should be either in comparison with other companies or with what is possible? We are immediately confronted with the lack of a satisfactory standard of expense. The premium income must be ruled out except for such expenses as commissions and state taxes on premiums, and possibly for a few cases of comparison of one year's experience with another where a company is grow-

ing comparatively slowly or at least in such a manner that the effect due to growth can be allowed for when comparing the expense rates.

In his paper on "The Analysis of Life Office Accounts" in the 1904–5 volume, page 89, of the *Proceedings of the Insurance Institute of Toronto,* Mr. Percy C. H. Papps has clearly shown the meaninglessness of three standards in common use,—the ratio of expenses to premium income, to total income and to the mean insurance in force, these all placing rapidly growing companies at an unfair disadvantage due to the mere fact that new business expenses are higher than renewal. None of the ratios make proper allowance for the different proportions of Term, Life and Endowment business. The first two make no provision for varying proportions of paid-up insurance.

The comparison of expenses with the mean insurance in force is still used by one of the insurance publications and was adopted by Dr. Frederick L. Hoffman in "Fifty Years of American Life Insurance Progress" in New Series, No. 95, page 667, of the *Publications of the American Statistical Association.* The unsatisfactoriness of this basis of comparison may be illustrated by assuming two companies conducted at the same true expense rate, both with $100,000,000 renewal business, one issuing $10,000,000 new business and the other $25,000,000. Assume that for these companies the ratio of 10 to 1 between first year and renewal cost holds and that 5 per cent. of the business exposed will terminate before the end of the year. At any assumed renewal expense rate then, the expense per $1,000 mean insurance in force will vary in the ratio of 1.96 to 3.20 between the companies, because of the difference in proportion of new business transacted. While a variation in the relative first year and renewal expense and lapse assumptions made might vary the ratios, the change would be slight compared to the inherent error in the method.

One insurance publication gives the ratios by companies of the incurred expenses to the premium loading, both taken from the Gain and Loss Exhibit. A considerable proportion of non-participating insurance is now issued at premiums with no loading. The ratio mentioned on this portion of the business is, therefore, mathematically infinite. These ratios make the com-

panies that charge the highest premiums appear most economically managed.

As previously suggested the English have frequently assumed a standard percentage like 7½ per cent. as the ratio of renewal expenses to renewal premiums, then comparing companies by the resulting ratios of first year expenses to first year premiums. This has been varied by assuming a standard first year expense rate and comparing the resulting renewal rates.

Various schemes have been used to eliminate some of the worst features of the above comparisons. For instance, two different assumptions have been made that the first year expense rate is ten times the renewal by calculating the ratio of renewal expense to renewal business by the formula

$$r = \frac{E}{10N + R},$$

where E represents the insurance expenses, N the new business and R the renewal. N and R may be taken either as Premiums, as was done by Mr. Papps in his paper just referred to and is done now by an insurance publication, or as Insurance in Force as is done in another publication. Thus, in the case where the ratio of expenses to premium is taken, the expenses would be stated as perhaps 92 per cent. of the first year premiums and 9.2 per cent. of the renewal premiums. In the other they would appear as, for instance, $4.90 per thousand new business and $.49 per thousand renewal insurance. Of course, these relations are true only if the fundamental assumption is true. But the latter appears in many cases to be far from true, especially in a company where the new business is perhaps one-fourth or one-third of the renewal. Mr. H. W. Manly, in his opening address as President in Vol. XXXV, page 97, of the *Journal of the Institute of Actuaries* says: "I could never see any possible reason in this (method); but the computer gets the reputation of being very clever to perform such an intricate piece of calculation, and it has the merit of escaping the absurd situation" which may result from using either of the methods referred to in the preceding paragraph.

In "Life Assurance Trading" in Vol. II, page 51, of the *Transactions of the Insurance Society of Edinburg,* Mr. A. D.

Lindsay Turnbull assumes arbitrary expense deductions from the interest rate and similar expense rates on renewal premiums, both allowances decreasing with the size of the company considered, and assesses the remaining expenses, after allowing for annuities, against both the first year premiums and the new business paid-for. It appears that showing both results together might give better results than any of the methods previously mentioned, if the arbitrary factors are properly chosen.

One insurance publication uses perhaps a better method in showing four ratios together, ratio of acquisition expense to first year premiums, acquisition expense per thousand new business, ratio of other expense to total premium income and other expense per thousand to total insurance in force. These factors as published are unsatisfactory because they necessarily make no allowance for Group insurance or the other classes of business. Besides, it is hard to place much confidence in the comparability of the acquisition expenses reported in the general interrogatories in the Gain and Loss Exhibit. But the greatest trouble in these ratios is that acquisition expense, that is, practically entirely commissions and medical and inspection fees, is alone considered instead of all first-year expenses.

Each of the four factors used in this publication involves its own inaccuracies, but when taken in conjunction with each other, a more comprehensive view is obtained. Of course, their significance appears to be harder to grasp, but this is merely the result of attempting to understand a complicated problem instead of blindly accepting an incomplete and probably erroneous simple statement.

The same remarks may be made about the ratios shown in two other publications,—in one, net expenses to mean insurance in force, net expenses to premium income, cost of new insurance and first year expenses to first year premiums, and in the other, first year commissions to new premiums, total first year expense to new premiums, total insurance expenses less first year expenses to renewal premiums and total first year expense to first year margins. The only really new element among these ratios is the latter in which acquisition expense is compared with the sum, according to Schedule Q of New York State, of loading and mortality savings under the Select and Ultimate American Experience table as compared with the American Experience

table itself. Among other difficulties involved here are that only acquisition expense is considered and that companies with small loadings are at a decided disadvantage unless they issue a large proportion of term insurance on which the mortality savings, as the law has been interpreted, are comparatively large.

Deduction of the acquisition expense from the total involves an error that may be separately investigated. The former is based on assuming that all new business not already lapsed is in force for a full year with commissions for the full year included, all as required by Schedule Q of New York State. In other words, these commissions include those on deferred and outstanding first year premiums as of the end of the year of the statement. Hence it is not proper to deduct them from the total expenses actually paid as the latter include some of the expenses outstanding at the beginning instead of those at the end of the year. Even if the total expenses are taken on an incurred basis from the Gain and Loss Exhibit it is still not strictly correct to deduct such acquisition expenses from them, as the same fallacy creeps in that has into some discussions of incurred premiums and expenses. It has been maintained by a few actuaries that because only part of the premiums outstanding at the end of any year are collected in the succeeding year, only such premiums as are actually received should be included (when calculating the next year's premium income) as outstanding at the beginning of that year. Practically what has happened is that the outstanding premiums that proved uncollectible have been written off as a bad asset. Perhaps in one sense they should not affect the true premium income of the year in which they are written off, but in a broader sense they should. Following the present Convention edition of the annual statement literally adjusts a year's income by the amount by which the previous year's income proved incorrect. Where should this loss be allocated if not to the item in which what may be said to have proved to be an error occurred? In the case of combination of several successive years the total results are, therefore, correct if the annual statement method is used literally (except for the comparatively slight inaccuracies in the first and last years used). If the loss due to such uncollected premiums is not adjusted in the incurred premiums, where

should it be shown in the annual statement? The situation in the case of incurred expenses is exactly similar. If the liability for some large tax item is incorrectly estimated, correction is automatically made in the next year's incurred expenses.

Suggested Standards of Expense.

The three most satisfactory standards of comparison for a company's own use that occur to me are (1) that based on the real loading in the premium as already suggested, (2) a determination of the factors necessary to compute premiums and test their adequacy and (3) a computation of the ratio of actual to "expected" expenses.

In the paper of Mr. E. B. Morris referred to previously, he suggested that a company should have for its own purposes a Reserve valuation and a Gain and Loss Exhibit that would indicate its true condition. Perhaps the American Men Select Table with 4½ per cent. interest would fulfill the requirement leaving as little margin of safety in the interest rate as would be desirable. The Gain and Loss Exhibit with net premiums, the interest required to maintain the reserve, the reserve released by death, lapse, etc., on this basis, would be very valuable, giving the best analysis of the company's status possible under the net level premium valuation system. The principal element lacking is a comparison of future expenses with the loading to be available to meet them. Despite this lack, such a valuation would be immensely superior to that on a legal standard, though nothing is intended to be inferred from this statement that a change in the legal standard is advisable. No change should be considered that would impair in the least the position of the policyholders. It may not seem necessary to companies with reserves much in excess of what would be absolutely necessary, especially if they have great margins of safety in their premiums, to make such a valuation, but to most companies nothing could be more illuminating.

To be of maximum value such a valuation should be carried out with the first year business throughout entirely separated from the renewal. The result, as far as expenses are concerned, will be that two ratios will be obtained, (1) first year expenses obtained as suggested above to first year loading and (2) renewal

expenses to renewal loading. These taken together will in the course of a few years, when there is opportunity to study the results of several years together, be one of the most important standards of comparing one year's expenses with another.

Inasmuch as a large part of our expense investigations is either to enable us to compute premiums or to check up that our present assumptions are yet warranted, it is natural to investigate our expenses in accordance with the factors used in computing the premiums, particularly in the case of non-participating companies. Mr. Cammack, in his paper previously referred to, used as expenses, besides the commissions, a first year expense of $4.50 per thousand new business and a renewal expense of $1.50 per thousand renewal business together with 3 per cent. of the premiums both first year and renewal.

These can be considered as the fundamental factors though others can be introduced if refinements are desired. Thus, some expenses really vary more in proportion to the number of policies issued than in proportion to the amount of insurance. The latter is such a direct function of the former, however, that for general purposes the latter can usually be used satisfactorily, especially as it is a very desirable simplification in analyzing expenses. In the calculation of premiums and testing their adequacy, however, it is very desirable to introduce a modification in expense per thousand insurance to properly allow for the number of policies involved, this by the device of adjusting the general flat expenses according to the average-sized policy issued under each form of policy and age at issue. Thus, under Mr. Cammack's assumptions, if the average-sized policy issued on regular business is $3,400, the average expense per policy is $15.30 first year and $5.10 renewal. If the average-sized Twenty-Payment Life policy issued at age 25 is $2,300, the average expense per thousand as modified is $6.65 first year and $2.22 renewal. With modifications for the largest policies it will be seen that under ordinary underwriting practice most expenses (as cost of medical examination, inspection of risk, medical and other underwriting, cost of typewriting the policy and record cards, punching Hollerith cards, if used, valuing the policies, reporting premiums, making changes in beneficiaries or other features of policies, granting policy loans, working mortality experience, etc.), vary more directly with the number of policies handled

than with the amount of insurance. New problems are, of course, introduced if the company issues small policies without medical examination. If anyone should consider that some of the expenses vary somewhat in proportion to the number of policies and somewhat with the amount of insurance, part of the general average expense per thousand insurance may be left unmodified by the device mentioned and later combined with the part modified.

The following table illustrates the great variation in the average-sized policy by age at issue and form of policy. The figures are merely illustrative as they are several years old, not reflecting the larger-sized policies now being issued, and would, of course, be applicable to no other company. It might be noted, however, that the important point is not their absolute size but their relative magnitude.

GRADED AVERAGE-SIZED POLICY.

Based on Issues of 1917–19 Inclusive.

Age at Issue.	Ord. Life.	20-Pay't Life.	15-Pay't Life.	10-Pay't Life.	30-Yr. End't.	20-Yr. End't.	15-Yr. End't.	10-Yr. End't.
20....	$1,900	$1,800	$1,700	$1,500	$1,700	$1,200	$1,200	$1,100
25....	2,800	2,300	2,400	3,500	2,400	1,500	1,300	1,200
30....	3,700	2,800	2,900	4,000	3,000	1,800	1,700	1,800
35....	4,600	3,300	3,400	4,000	3,500	2,200	2,200	2,300
40....	4,900	3,600	3,900	4,000	4,000	2,300	2,400	2,800
45....	5,100	3,900	4,300	4,500	4,000	2,400	2,700	3,300
50....	5,200	4,100	4,500	4,500	3,000	2,600	3,000	3,700
55....	4,900	4,100	4,000	4,000		2,800	3,500	4,000
60....	4,500	3,500	3,500	3,500		3,000	3,500	3,900
65....	3,000	3,000	2,500	2,500		2,500	3,000	3,500

General average, — all forms and ages, $3,400.

If expenses vary principally with the number of policies, this table illustrates the comparatively high expenses experienced on Endowments, especially short term, and at young ages as compared with old. In fact, if consideration were given to this factor alone non-participating rates at the youngest ages would have to be increased and dividends on participating policies likewise reduced.

In obtaining the fundamental expense factors, commission rates are generally best treated separately. Being usually based

directly on premiums, the ratios of the former to the latter, taken separately for first year and renewal, are the significant ratios. These rates taken separately for each class of business and studied for a period of years throw light on the effect of the company's practices in issuing new forms of policies, restricting term business, changing the commission rates to agents in any particular, or experiencing a shift in business as, for instance, towards Endowment insurance. If the company has direct agents perhaps with 5 per cent. renewals and general agents with 7½ per cent. renewals, the combined renewal rate reflects the relative distribution in the business from the different classes of agents. It also reflects the relative proportion of old business if commission rates are paid on a lower scale after policies have run a number of years. All these commission rates are much more significant if the commissions are compared with commission-paying premiums, that is, if premiums on which commissions are no longer payable are excluded in the comparison or at least if the comparison is made both with and without such premiums. This will be practically impossible if a division between commission-paying and non-commission-paying premiums is not made on the ledgers. As far as the use of expense investigations for computation of premiums is concerned, it is better in general to disregard any actual ratios obtained of commissions to premiums based on past conditions (except as they indicate the proportion of agents' and of general agents' business) and to use the commission scales included in present agents' contracts.

There are three methods of determining the expense ratios corresponding to the factors in the formulae, (1) by solving systems of simultaneous equations, (2) by apportioning all expenses directly as well as possible and (3) by determining by the "trial and error" method the best basis of computing the "expected expenses" as described later. If X equals the expense per thousand new business, Y equals the expense per thousand renewal business and Z the expense per dollar premium income, we may write $X \cdot$ (amount of new business in thousands) $+ Y \cdot$ (amount of renewal business in thousands) $+ Z \cdot$ (premium income) equals total expense on an incurred basis for the kind of insurance under consideration. If the factors X, Y and Z were only constant or nearly so, these equa-

tions could be written for three successive years, thus enabling us to solve for the unknowns. Factors could be obtained for several succeeding combinations of three successive years and the most probable values of the factors computed by the method of least squares. It is possible that for companies writing comparatively little new business or at least expanding uniformly this method could be used. The writer has allowed for such disturbing influences as could be recognized, such as large fluctuating franchise taxes, the federal tax on new business, and change in accounting methods (as for instance the setting up of a special tax liability where none had been carried before, thus practically doubling that incurred item for the year), and yet he has been unable to obtain satisfactory results even after experimenting on the statements of some of the moderately sized uniformly growing conservative companies. He has even found negative factors which, though perfectly good mathematics, scarcely served his purpose. One disturbing feature that might be overlooked is that premium taxes paid are proportionate to the premiums of the previous year instead of the current, though this will be corrected on the incurred basis if the tax liability is correctly computed. It is somewhat disappointing to obtain such results when it would at first seem that this method would automatically give the correct results with practically no work as compared with the great amount of work involved in other methods. The solution must be that these factors are not constants. This would be true if the expense of opening up new territory or developing old territory were high in some years as compared with others. It is also true in some cases due to taxes which are beyond the control of the company. The factors have recently been particularly unstable due to the economic disturbances of the war and post-war periods.

As to the first method suggested to determine the expense factors, a complete separation of first year and renewal expenses could, of course, be made on the books. But an approximation will be sufficiently accurate for practical purposes. The best way seems to be to have those that should have the most intimate knowledge as to each class considered estimate the proportion that the expense on that class chargeable to first year business bears to the total, and obtain a final average ratio (weighted average if desired) for each class of expense. The total first year expenses per thou-

sand new business are then easily obtained, and then the renewal.

The percentage of premium factor to be used, both in the first and subsequent years, is obtained from the state taxes on premiums and similar expenses, the taxes paid, of course, being compared with the preceding year's premiums on which they are based.

The wide difference in opinion as to what proportion of expenses are first year and what are renewal is surprising. At one extreme they assume that most expenses are chargeable to first year, which would be the conclusion if attempt were made to imagine what the expenses would be if the company ceased to write new business under which condition a large share of the expenses would be eliminated. At the other extreme, they assess most of the expenses to the renewal business for various reasons, as, for instance, that new business is so desirable for the company as a whole that the old business should bear the expense of producing it. The final attitude assumed should vary with the purpose in view. To really obtain first year expenses those actually incurred as such should be ascertained as closely as possible regardless of the ultimate justification for them. Thus, for calculating non-participating premiums the incidence of expense is very important as it will make an appreciable difference in the resulting premium, particularly on a long premium paying policy, whether an amount like $1 is considered as first year expense and spread in the premium over a long period, increasing the premium perhaps eight cents, or whether the corresponding expenses are assessed to the renewal business, producing in a rapidly growing company a twenty-five cent increase in premium. Of course, the faster the company is growing the more important as well as difficult is it to secure the correct division. But for other purposes, as, for instance, in dividend calculation, there may be justification for considering expenses incurred in the first year as assessable against renewal premiums, thus virtually spreading such expenses over a longer period, producing an effect somewhat analogous to that of the formulae used in computing non-participating premiums.

A comparison of the factors obtained from successive years' experience (with allowance for abnormal conditions such as the federal tax on new business) gives a very valuable standard of comparison for a company's own use—at least in the case of a

non-participating company, and it seems as if such a comparison would also be very valuable for a participating company.

The third standard of comparison of expenses is obtaining by the "trial and error" method what may be called the ratio of actual to "expected expenses." For each company's own use the standard should be adjusted to fit its peculiar conditions. Some companies pay comparatively high first year and low renewal commissions. Others do the reverse. For the more general comparison between companies as given in the following table, I have modified Mr. Cammack's assumptions of $3 per $1,000 medical and inspection expense on new business, $1.50 per $1,000 both first year and renewal insurance, and 3 per cent. of the premium income.

The excess of first year expense over renewal is evidently much greater than that due to medical and inspection expenses only. On the assumption of first year expenses being ten times the renewal, this factor should be much greater than $4.50 per thousand. Many of the following ratios were first worked both with $10 and with $4.50 first year expense as well as with intermediate values. While it is recognized that the $6 chosen is arbitrary, it seemed to give the most satisfactory results. $0.80 per thousand was added to the first year flat expense on business paid for between November 1, 1917, and December 31, 1921, to allow for the federal tax on new business. Mr. Cammack's renewal expense of $1.50 per thousand is probably reasonably correct where some of the business is done on a branch office system. With the high renewal rate of commission used here $1.15 per thousand seemed to give most satisfactory results. I have somewhat arbitrarily assumed a first year commission rate of 45 per cent. computed on strictly first year premiums excluding annuities and "dividends applied to purchase paid-up insurance and annuities," but including disability and additional indemnity premiums. In the case of reinsurance premiums paid, if it is obvious from the average premium paid per thousand reinsurance in force that this is principally on the amount at risk plan, "expected" commission is computed because it is considered that the commission paid the agent on them is relatively more important than any commissions received on the reinsurance. But if it appears to be on the coinsurance plan, "expected" commission

is not used because it is assumed that the company will be reimbursed for the commission paid the agent. This whole process is, of course, a very rough approximation especially as in some cases the commission is reduced on large policies issued over the company's limit of retention. The 45 per cent. may be too low an average for some companies, but it appeared to give more consistent results than an assumption of 50 per cent. Besides, it appears reasonable as compared with Mr. Cammack's assumptions of 50 per cent. on Ordinary Life, 40 per cent. on Twenty-Payment Life and 30 per cent. on 20-Year Endowment policies, since participating companies issue such a large percentage of business on the Ordinary Life plan. The actual percentage of first year commissions to premiums in 1921 for the nine large companies considered was 45.2 per cent. A renewal rate of 6.25 per cent. was used because the actual rate on the same companies in 1921 was 6.23 per cent. Mr. Cammack's assumptions were 7½ per cent. for nine years, 5 per cent. for the next five and 3 per cent. collection fee thereafter. The 6.25 per cent. was computed on renewal premiums excluding annuities and dividends applied to shorten the endowment or premium paying period and including disability and additional indemnity premiums, with reinsurance treated as in the case of the first year.

The renewal business was taken as that in force at the beginning of the year. There may be some question whether the mean in force would not be better if that were available, but on the other hand the greatest actual expense is on the terminations, so they should be counted at least for their full amount. Only strictly new-paid-for business was considered as first year. Annuity commissions are excluded from the actual expenses which were taken as the incurred expenses in the Gain and Loss Exhibit.

It is recognized that all such methods are necessarily rough and involve many of the errors criticized in discussing the ratios now in use. Particularly is this true in comparing companies with each other, but these comparisons are the results of many trials chosen as far as possible without bias and given primarily as illustrations of the method. Furthermore, as appears later, the errors in the factors have less effect on the results than might be imagined. For instance, if the 6.25 per cent. renewal expense based

on premiums is considered by anyone to be too low, it is more than likely that increasing it would be largely counterbalanced by decreasing the flat charge of $1.15 per thousand. The net effect on the ratios shown would be comparatively slight because the average premium per thousand insurance in a given company is reasonably constant. The small relative effect even of changing the 6.25 per cent. and $1.15 factors to 5 per cent. and $1.50 is shown on the total for all companies on the first line added at the end of the table.

All the first nine companies compared in the following table are among the twenty largest in the country. None are included whose results would be vitiated by Industrial or Group business. Of course, Reinsurance Acquired could not be considered, but that would be negligible in the companies considered. The last three companies shown are smaller, but each has somewhat more than $100,000,000 insurance in force. They comprise a participating company on the level premium reserve basis, and a participating and a non-participating company on the modified preliminary term basis. In the smaller companies it is probable that the proportion of first year expenses is comparatively greater than in the largest, and it is not proper, therefore, to use the same factors as in the case of the others. In fact, they are included to illustrate the dangers of the method which, while it may have some advantages for comparison of companies, has much greater merit for the comparison of one year's experience with another in the same company. Such a comparison is somewhat unfair to a company charging low premiums, as part of the expected expenses are too small, producing slightly too high ratios. The ratios are slightly too low for companies issuing a large proportion of term insurance.

So that others may better estimate the relative effect of changing the factors, the last four lines have been added to the above table showing the results for a decade of each company when the Expected is computed according to the following bases, in all of which 45 per cent. First Year Commission is used:

I. $6.00 Flat First Year Charge with $1.50 Renewal and 2 per cent. of the Total Premiums with 5 per cent. Renewal Commission.

Calendar Year.	Company.												
	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	Total *A–I*, incl.	*J*	*K*	*L*
Ratio of Actual to Expected Expenses. (On basis described above.)													
1912	103.5%	94.0%	97.0%	92.3%	99.7%	103.6%	107.1%	109.0%	113.8%	98.8%	152.0%	121.1%	139.2%
1913	103.3	94.0	101.4	90.3	97.0	104.6	109.6	107.6	111.6	99.5	141.7	119.8	140.0
1914	102.7	93.6	103.6	89.4	100.5	105.8	107.5	114.1	135.7	102.1	138.1	128.1	154.1
1915	102.0	92.6	103.9	89.9	106.4	104.8	110.9	112.1	96.3	100.3	135.3	127.9	151.5
1916	101.5	90.2	101.6	91.9	96.2	105.2	105.4	108.6	107.7	98.5	136.2	124.9	151.1
1917	10.38	93.6	99.5	94.7	98.3	103.8	113.3	106.0	146.4	101.9	140.2	126.0	147.5
1918	101.0	93.5	104.4	89.2	95.7	102.2	111.8	108.3	112.9	99.9	146.5	129.0	138.3
1919	100.8	91.6	87.5	85.0	91.7	96.1	100.6	103.6	106.0	92.7	135.0	119.0	107.3
1920	101.8	93.1	109.0	91.1	102.6	98.9	105.1	105.8	110.5	101.3	138.0	120.4	147.9
1921	103.1	100.7	102.0	92.4	97.4	99.1	107.2	111.9	122.0	102.1	—	—	—
Total	102.2	93.9	101.0	90.6	98.3	101.3	107.3	108.3	116.3	99.6	139.8	123.6	139.5
Results of Modifying Factors, as Applied to Totals for 10 Years, 1912–1921, incl.													
I	102.6	94.5	101.6	91.0	99.0	101.6	107.5	108.7	117.1	100.2	139.3	124.0	139.7
II	101.8	95.3	102.2	90.8	98.4	99.8	107.4	107.1	115.4	100.1	134.6	125.2	136.8
III	95.9	86.9	93.8	84.5	91.7	95.5	100.2	101.9	109.2	92.9	134.0	114.6	132.3
IV	103.2	94.2	101.3	91.2	99.2	102.7	108.0	109.6	117.7	100.3	142.7	123.9	141.5

II. $10.00 Flat First Year Charge with $0.55 Renewal and 2 per cent. of the Total Premiums with 6.25 per cent. Renewal Commission.

III. $4.50 Flat First Year Charge with $1.50 Renewal and 3 per cent. of the Total Premiums with 6.25 per cent. Renewal Commission.

IV. With the same assumptions as the preceding except that 1½ per cent. of the Total Premiums is taken instead of 3 per cent.

While the absolute percentages of Actual to Expected are modified there is comparatively little relative change in companies of the same class.

Another problem is comparatively easily solved after the first year expenses and first year mean reserve on new business have been obtained, that is, estimating the amount of new business a company can issue the next year without impairing the surplus. A combination of first year premiums, claims, expenses and reserve, together with interest obtained as previously described, gives the loss per $1,000 new business. The corresponding renewal items give the gain per $1,000 renewal business. With these factors as well as the amount of renewal business with which to commence the new year, the amount of new business that can be written with no effect or with a definite effect on the surplus can be roughly estimated, the principal assumption being that the mortality will remain the same. Of course, similar estimates available for several successive years materially aid such estimates, and the normal rate of mortality can be used to better advantage than the actual if the latter is abnormal.

Discussion of Preceding Paper.

(ORAL DISCUSSION.)

MR. E. B. MORRIS:

Mr. Elston's paper deals with the problems of a multiple line company. The multiple line company must know how it stands on each class of business that it writes—regular business, group, wholesale, re-insurance, etc. The total surplus or increase of surplus of the company, of course, will not reveal the defects on any particular line.

The point I wish to emphasize is the closing paragraph of his paper in which he brings out the possibility of estimating in advance the amount of business which a company may do without affecting its surplus. That we have found to be very valuable. Take, for instance, the year 1920 with its very large volume of business—if the company did not know in advance how much business it could write without reducing its surplus, or, to put the matter in another way, how much business it could write and not reduce its surplus too heavily, it would have been in a rather embarrassing position. By the formula he has given, showing the loss per thousand of new business and gain per thousand renewal business, the equation is easily made up.

MR. E. W. MARSHALL:

Mr. Elston's paper is particularly appropriate at this time. Business generally has been through an era of more or less extravagant spending and high prices. In every branch of industry the question of expense is receiving most careful attention. Mr. Elston's paper therefore will be helpful as an aid to the solution of some of the problems that are now arising in the consideration of the expense problem in the life insurance business.

There is an interesting table near the end of the paper giving a comparison of expense rates of various companies. This comparison is made by applying certain factors to the various items of a company's business in order to obtain the "expected expenses." By obtaining each company's percentage of actual to expected expenses a comparison may be made of expense rates of various companies.

There are of course as Mr. Elston indicates, several statistical inaccuracies involved in such a table. In some cases these inaccuracies will impair the value of the results to a slight degree.

For example, in computing the expected expenses, a 45 per cent. expected first-year commission is used in all cases. This rate might hold where all the companies under observation are writing practically the same proportion of life, endowment and term business respectively. If, however, one company is writing the majority of its business under the life plan and another the majority of its business on the endowment plan the ratio of actual to expected expenses may be affected thereby. A similar result would obtain if one company wrote largely whole life policies and another largely 20-payment life policies. This emphasizes the warning contained in Mr. Elston's article that while his method "may have some advantages for comparison of companies" it "has much greater merit for the comparison of one year's experience with another in the same company."

Within recent months our Company has made expense investigations using a slightly different method. We wished to deter-

mine what the expenses of our Company would have been had it experienced the expense rates of other companies. In the course of the investigation we found that, as above indicated, the comparison of first-year commission rates is difficult because companies issue varying proportions of the various plans of insurance with corresponding variations in first commission rates. We found that, for our purposes, this disturbing element would be minimized by (1) finding the percentage of first-year commissions to first-year premiums for the companies under observation and applying this per cent. to our Company's first-year premiums, and (2) finding the first year's commission paid per $1,000 of new insurance in the companies under observation and applying this amount to our new insurance, and taking the mean of the commissions found according to these two methods. This of course, is not strictly accurate, but it reduces the discrepancy where companies have about the same first-year commission rates but different distribution of business by plan.

The method of making expense comparisons by use of a percentage of actual to expected expenses for different companies, is so helpful that it merits as much refinement as can practically be given to it.

MR. M. M. DAWSON:

I am of course interested in this paper as I was one of the earliest to direct attention somewhat emphatically to the necessity of having some such standard.

The view which I expressed at the time the Armstrong laws were before the legislature, namely, that publicity in the end would be a better corrective than compulsion, is now pretty thoroughly demonstrated to be true; for there is not much left of the Armstrong laws today, so far as restraint upon practices of companies is concerned, except the publicity; and there is not so much of that as there ought to be.

If the members of this Society would give serious attention to this matter and would work out a reasonable standard by which the expenses of companies could be compared, then by including such returns in the gain and loss exhibit very much more good would result than has been accomplished by the Armstrong laws. Certainly some of the practices which your agency departments know, even if you do not, have crept into the life insurance work in spite of the provisions of those laws, would thus be exposed.

The present situation is that, as regards participating companies which have been established for some time, the loading on renewal premiums is so large in the aggregate—with the exception of two such companies, which became mutual a few years ago—that there is no restraint and no fair basis for comparison, as regards total expenses. In consequence the practice has grown up

of shifting what is really a part of the first year's cost against the renewal premiums.

Consequently, a paper upon this subject is indeed timely for there is much need for light upon it.

(AUTHOR'S REVIEW OF DISCUSSION.)

MR. JAMES S. ELSTON:

In the paper itself I tried to emphasize the inconsistencies and unfairness in comparison of expenses between companies. Now I would further like to emphasize the question of the actual amount of expenses. The distribution between investment and underwriting expenses is not on the same basis in all companies. Furthermore, in some companies underwriting expenses are concealed in the Disability and Additional Indemnity Gain and Loss item. This was particularly true in the case of one of the companies that showed a very favorable expense rate. In fact there was so much of this expense which was impossible to separate in the annual statements that if time had permitted I would have re-worked the table excluding that company.

There is one variation of the methods of separating expenses between departments particularly applicable to branch offices which might be mentioned. As many accident policies are written practically entirely in branch offices, while life applications are merely transferred to the home office, the branch office expenses in connection with accident policies may be several times as great as those in connection with life policies. Comparative expenses of other casualty policies would also vary. By "time studies" or some other method of investigation the rate of expense per policy could be ascertained on a representative group of business and comparative cost factors per policy for each kind of business obtained. The total expenses to which the method is applicable can then be apportioned according to branch by weighting the number of policies, or possibly the amount of premiums in each kind of business.

The following papers in the Journal of the Institute of Actuaries should have been mentioned—one by H. J. Rietschel, XLIV, 415, and one by Charles H. Maltby, XLIX, 111.

The Incidence of Substandard Mortality.

BY

JAMES E. HOSKINS.

1. Available Data.

Although adequate consideration has been given in our *Transactions* to the practical application of the various methods of rating impaired lives and to the amounts of rating appropriate to the principal impairments, the actual incidence of substandard mortality and its effect upon premiums and reserves is still largely a matter of impression. Broad general statements have been made as to the probable trend of the incidence, but no comprehensive investigation has been made of this phase of the subject. The opinion indeed has sometimes been offered that it is not possible to make a definite statement of the actual incidence.

It is true that no such exact statement can be made in the sense that the actual results will never quite coincide with the expected. In the same sense no exact statement can be made of the rate of standard mortality. We do, however, set up a standard to which the expected results conform within reasonable limits of error; and the more extensive our data, the more closely will the actual results approximate the expected.

In the matter of substandard mortality the Medico-Actuarial Investigation affords abundant evidence on the subject, which while not of sufficient volume to give results as reliable as a standard mortality table, may nevertheless show very definitely the trend of the incidence of extra mortality. The way to this use of the Medico-Actuarial data has been shown by papers presented by Mr. Welch (*T. A. S. A.*, XVII, 17) and Mr. Moir (*T. A. S. A.*, XVIII, 311), and by Mr. Gore's discussion on Mr. Arthur Hunter's paper entitled "Practical Treatment of Underaverage Lives" (*T. A. S. A.*, XVI, 340). Mr. Welch and Mr. Moir showed graphically the mortality by attained age among certain of the Medico-Actuarial impairment classes. Mr.

Gore calculated the ratio of ultimate actual to expected mortality of all the impairment groups in Vol. IV of the Medico-Actuarial report which showed aggregate ratios of 125 per cent. or more, based on not over 100 deaths. This was tabulated by entry ages rather than attained ages, and while it included several classes the exact mortality of which might on general principles be expected to decrease with age, it did not cover the most important of such classes—namely those with a family history of tuberculosis, which appear in Vol. V of the report.

For purposes of this investigation I have taken a number of the Medico-Actuarial classes, chosen so as to yield a large body of statistics on representative groups of impairments.

2. Method used for Calculating Extra Mortality by Attained Age.

Ultimate mortality, and ultimate premiums and reserves were considered, on the ground that companies can obtain almost any desired mortality during the select period by sufficiently careful selection, whereas ultimate mortality is more nearly in the nature of an absolute fact. Inasmuch as the mortality ratios obtained were later applied, for the purpose of obtaining premiums and reserves, to the American Men table, in which the select period is taken as five years, ultimate mortality was taken as excluding the first five years, instead of four as in the M.-A. standard table.

The actual and expected deaths were then grouped by attained age in the following manner. The figures for insurance years 6 to 10 were assumed to be grouped in year 8, those for years 11 to 15 in year 13, etc. Policies issued at ages 15 to 19 were assumed to be issued at age 17, and the other groups of entry ages were similarly treated. This grouping is not strictly accurate; for instance, as Mr. Welch points out in his paper, the best equivalent age for the group 20 to 24 is age 22½. It was not expected, however, that the ratios finally brought out would be accurate within so narrow a limit of error as to justify such refinement. The results show the propriety of this view.

The entrants at ages 50 to 53 and one-third of those at ages 54 to 56 were treated as entering at age 52. The remaining two thirds of the entrants at 54 to 56 and all entrants at 57 to

59 were treated as entering at 57. All entrants at ages 60 and over were grouped at age 62.

Accordingly the deaths at attained age 60, for example, comprised the following:

Entry Age,		Insurance Years.
35–39		21–24
40–44		16–20
45–49		11–15
50–53		6–10
54–56	(one-third)	6–10

3. Classes with Increasing Extra Mortality Percentages.

The classes used which were expected to show an increasing extra mortality were as follows:

Class Number.	Impairment.
	Found on Examination.
7-*K, A*	Albumin, without examination for casts. (At examination or within less than 2 years).
18-*K*	Habits as to alcohol, steady free user (conservative and liberal interpretation combined).
31-*K*	Pulse rate 90–100 at time of examination.
42—Build group 2, girth group *A*	Abdominal girth greater than chest expanded—15% to 25% overweight —excess of girth 0 to 1 inch.
(Vol. II, page 89)	35–45 pounds over average weight, height 5′ 7″ to 5′ 10″ inclusive.
	Personal History.
2 and 3-*B, C*	Syphilis, surely; not thoroughly treated or no details of treatment given, 2 to 10 years prior to examination.
12a-*A, B, C, D*	Gall stones, hepatic colic, one attack at any time.
12b-*A, B, C, D, J*	Bilious colic, one attack at any time.
25-*A*	Rheumatism, acute articular (muscular rheumatism excluded) once within two years.
40-*A, B, C*	Stricture of urethra, once within 10 years.

The results were as follows:

TABLE 1

TOTAL OF IMPAIRMENTS WITH GENERALLY INCREASING EXTRA MORTALITY.

Attained Age.	Actual Deaths.	Expected Deaths.	Ratio Actual to Expected %
25	9	5.30	170
30	55	57.94	95
35	216	155.03	139
40	373	269.45	138
45	511	374.96	136
50	730	490.42	149
55	764	520.69	147
60	734	485.94	151
65	572	416.90	137
70	322	268.97	120
75	110	89.07	123
80	25	18.98	132
85	2	.97	206
Total	4,423	3,154.62	140

Practically all of the most important classes are included in the preceding tabulation except those which may be expected to show a generally decreasing extra hazard and excepting the overweight groups, of which only one is included. Overweight applicants were probably accepted much more frequently at standard rates by the companies contributing their experience than were applicants having other impairments; and to include a large amount of data on overweights in this investigation merely because the overweight classes were large in numbers would result in giving too great importance, in the combined figures, to one particular hazard. The one overweight group included gave 1378.38 of the 3154.62 expected deaths and a corresponding proportion of the actual. From this it will be seen that overweight risks were given due weight in the tabulation. On the other hand, a number of the less important classes were included, so that the data used might be thoroughly representative.

No figures are produced below age 25, for obvious reasons; and even at age 30 the data is scarcely dependable. At the extreme high ages, too, the ratios are unreliable. But in spite of the uneven progress of the mortality ratios, unmistakable char-

acteristics appear in Table 1. The extra mortality, expressed as a percentage of the standard table, starts a little below the general average, increases to a point somewhat above the general average, reaches a maximum somewhere in the fifties, and then declines at least as sharply as it increased, going somewhat below the general average for all ages in the later years of life. This confirms the usual impression of the incidence of mortality on this type of risk and is virtually what is shown by Mr. Gore's tabulation to which I have referred.

It is interesting to note that both Mr. Gore's and the present tabulation, although made up from different viewpoints, and using only to a small extent the same data, give a mortality of 140 per cent. for all ages combined. The average rating imposed on substandard business by the company with which I am connected is not far from the same figure.

4. Increasing Extra Mortality—Same Data, Eliminating Certain Large Classes with Especial Peculiarities.

Another tabulation was made eliminating class 18-*K* (steady free users of alcohol),—which will be met with less often in future on account of prohibition—and the overweight class, which probably was not selected as stringently as most of the other classes.

TABLE 2.

Impairments with Generally Increasing Extra Hazard, Eliminating Liquor and Overweight Cases.

Attained Age.	Actual Deaths.	Expected Deaths.	Ratio Actual to Expected %
25	7	3.65	192
30	26	27.64	94
35	75	63.32	118
40	133	92.19	144
45	151	109.53	138
50	169	122.84	138
55	187	116.02	161
60	146	99.21	147
65	112	84.28	133
70	70	55.16	127
75	15	14.96	100
80	4	2.65	151
85	—	.19	—
Total	1,095	791.64	138

The results in this table are rougher than those in Table 1 on account of the small numbers, but show the same general tendencies.

As a side-light on the incidence of mortality among this class of risks the tables in Mr. Welch's paper on overweights, previously referred to, were grouped by quinquennial attained ages with results as shown in Table 3.

TABLE 3.

OVERWEIGHT.

Ratio Actual to Expected Deaths.

Attained Age.	15–20 lbs. O.W.	25–30 lbs. O.W.	35–45 lbs. O.W.	50–60 lbs. O.W.
30.....	93%	76%	35%	108%
35.....	74	115	138	122
40.....	87	136	117	130
45.....	109	125	149	151
50.....	118	123	153	185
55.....	106	133	145	188
60.....	121	122	141	181
65.....	106	125	134	151
70.....	118	87	142	148
75.....	35	59	97	80

Here again the same general tendencies are shown, although the ratio of actual to expected deaths for all attained ages combined is not available for comparison.

5. Increasing Extra Mortality—Special Tabulation of Heavily Impaired Classes.

Table 3 seems to indicate that the hump between ages 50 and 60 is most marked where the impairment is heaviest. To test this further, certain impairment groups which showed a high mortality ratio were segregated. These groups were numbers 2 and 3*B*, *C*, and 31-*K*. The ratio of actual to expected deaths is shown in Table 4, in which, although the amount of data is small, the usual general tendencies are clearly seen, together with the fact that the hump is very pronounced.

The first part of the investigation therefore shows that substandard mortality is not a constant percentage of the standard, but that for classes representative of those considered in the

Medico-Actuarial Investigation, the ratio is slightly less in the early years than the aggregate ratio for all ages combined, distinctly less in the late years, and somewhat greater in middle life. Consideration of extreme overweights and of other classes having high aggregate ratios leads to the conclusion that this divergence in middle life becomes more marked as the aggregate ratio increases. For this reason, the combined incidence of mortality will vary between companies according to the readiness with which the more heavily impaired risks are accepted. It seems probable, however, that the ratios in Table 1, properly smoothed, will apply fairly well to the insurance, as practiced today by leading companies, of substandard risks with a tendency to increasing extra mortality.

TABLE 4.

IMPAIRMENTS WITH HIGH AND GENERALLY INCREASING EXTRA MORTALITY.

Attained Age.	Actual Deaths.	Expected Deaths.	Ratio Actual to Expected %.
25.....	—	1.27	—
30.....	10	6.50	154
35.....	27	14.29	189
40.....	33	18.92	174
45.....	41	18.73	219
50.....	31	16.16	192
55.....	31	13.79	225
60.....	13	10.32	126
65.....	8	6.66	120
70.....	1	3.48	29
75.....	—	.59	—
Total.....	195	110.71	176

6. CLASSES WITH DECREASING EXTRA MORTALITY PERCENTAGES.

Groups which were expected to show a generally decreasing extra hazard were chosen as follows. There were no additional groups of this type which would have yielded any great amount of data.

Class Number.	Impairment.
Personal History.	
23-*A, C, D*.....	Pleurisy, other than purulent; within 2 years or over 5 years prior to examination.
26-*A, B*.....	Fistula in ano with or without operation, within 5 years.

Family History.

53.....Tuberculosis in one brother or sister, 5 to 45 pounds underweight.

These groups gave results as shown in Table 5.

TABLE 5.

IMPAIRMENTS EXPECTED TO SHOW GENERALLY DECREASING EXTRA MORTALITY.

Attained Age.	Actual Deaths.	Expected Deaths.	Ratio Actual to Expected %
25.....	9	6.30	143
30.....	89	63.55	140
35.....	230	158.20	145
40.....	317	253.24	125
45.....	373	336.82	111
50.....	384	403.52	95
55.....	317	407.64	78
60.....	268	365.88	73
65.....	242	299.67	81
70.....	133	172.58	77
75.....	48	54.43	88
80.....	10	11.50	87
85.....	—	.30	—
Total.....	2,420	2,533.63	96

On account of the very stringent selection exercised, the ratio for all ages combined is better than standard, and the individual ratios at the higher attained ages distinctly so. It seems reasonable that the effects of personal history might show in the ratios further into middle life than the effects of family history, especially as personal history of one of these impairments would be a somewhat serious matter at, say, age 45 at entry whereas family history of tuberculosis would at that age be almost negligible. Table 5 was therefore subdivided as shown in Table 6.

The expectation that the effects of family history would disappear sooner than those of personal history is seen to be realized. The data on the latter type of mortality, however, is too small to show clearly its incidence beyond a general tendency to decrease with age.

A further investigation of impaired family history was made by eliminating risks not over 20 pounds underweight at issue ages above 29 and by eliminating all cases of family history above entry age 39.

TABLE 6.

IMPAIRMENTS EXPECTED TO SHOW GENERALLY DECREASING EXTRA MORTALITY SUBDIVIDED INTO PERSONAL AND FAMILY HISTORY.

Attained Age.	Personal History.			Family History.		
	Actual Deaths.	Expected Deaths.	Ratio Actual to Expected.	Actual Deaths.	Expected Deaths.	Ratio Actual to Expected.
25.....	3	2.42	124%	6	3.88	155%
30.....	29	20.71	140	60	42.84	140
35.....	60	42.95	140	170	115.25	148
40.....	79	55.24	143	238	198.00	120
45.....	86	61.70	139	287	275.12	104
50.....	66	61.44	107	318	342.08	93
55.....	47	54.05	87	270	353.59	76
60.....	54	44.93	120	214	320.95	67
65.....	43	28.36	152	199	271.31	73
70.....	19	19.39	98	114	153.19	74
75.....	5	5.95	84	43	48.48	89
80.....	3	2.44	123	7	9.06	77
85.....	—	—	—	—	.30	—
Total....	494	399.58	124%	1,926	2,134.05	90%

Table 7 shows the figures for personal history of pleurisy (the classes named above) combined with risks who had tuberculosis in one brother or sister and who if admitted at ages 15 to 29 were underweight or if admitted from 30 to 39 were from 25 to 45 pounds underweight, no cases of family history being considered above entry age 39.

This shows, as expected, a tendency for the extra mortality to decrease throughout life, the decrease being marked after age 40, but never going below 100 per cent. except at one age where data is scanty.

Table 7 may be considered the best evidence we have of the incidence of extra mortality among risks with tendency to decreasing extra mortality, after excluding those applicants whose age nullifies the effect of a tubercular family history.

These classes are wholly unlike those with increasing extra mortality, and it is improbable that there are any gradations between these two broad groups. They are distinct, and may with propriety be treated each in a different manner, if desired, although the principle of insurance may be said to justify handling them together as one group.

TABLE 7.

RISKS WITH GENERALLY DECREASING EXTRA MORTALITY PERCENTAGES ADJUSTED TABULATION (PERSONAL AND FAMILY HISTORY COMBINED).

Attained Age.	Actual Deaths.	Expected Deaths.	Ratio Actual to Expected.	$(q_x + .002) \div q_x$.
25.....	9	6.25	144%	143
30.....	89	61.51	145	141
35.....	221	151.54	146	139
40.....	172	128.49	134	135
45.....	143	122.70	117	127
50.....	81	80.33	101	119
55.....	57	51.71	110	113
60.....	36	31.97	113	108
65.....	24	19.25	125	105
70.....	15	13.25	113	103
75.....	4	4.49	89	102
80.....	2	1.90	105	101
85.....	—	—	—	101
Total....	853	673.39	127%	

The table brings out the interesting and unexpected fact that the mortality ratios shown are very similar to those produced by assuming that the standard mortality rate is increased by .002. The extra mortality is therefore more accurately described as constant, a convenient fact if it is decided to treat both personal and family history by the same method of rating. Inasmuch, however, as these classes are commonly thought of as having decreasing extra mortality, we may well refer to them as risks with decreasing extra mortality *percentages*, and speak of classes involving the accident hazard as risks with constant extra mortality, remembering that in reality both have similar characteristics.

7. CLASSES WITH DECREASING EXTRA MORTALITY PERCENTAGES —FURTHER STUDY OF CASES OF FAMILY HISTORY TAKEN SEPARATELY.

It has been shown above that considering both personal and family history the incidence of mortality in the classes where a decreasing extra hazard is expected is very similar to that of a constant addition to standard mortality throughout the greater part of life. It has also been shown, however, that the inci-

dence of extra mortality due to family history shows a much more sharply decreasing curve. Table 6 showed a ratio of 90 per cent. for all ages combined, which obviously could not have been achieved without a very stringent selection. In order to segregate this class for further observation additional data was added by means of a very rough grouping, using figures on all classes in Vol. V of the Medico-Actuarial report which dealt with family history of tuberculosis in the case of underweight applicants. Here the ages at entry were grouped according to the groups in the Synopsis of the detailed tables (16–29, 30–39, etc.), and the attained ages were grouped decennially. The deaths for attained age 60, for example, comprised those among entrants from ages 40 to 49 in the 11th to 24th insurance years and entrants at 50 to 59 in the 6th to 10th insurance years. This grouping, rough as it is, corroborated in a general way the figures shown in Table 6 for cases of impaired family history, the results being as follows:

TABLE 8.

FAMILY HISTORY OF TUBERCULOSIS—UNDERWEIGHT APPLICANTS.

Attained Age.	Ratio of Actual to Expected Deaths.
30	146%
40	113
50	105
60	75
70	71
80	70
Total	93%

In order to consider, in the latter part of this paper, the effect on premiums and reserves of decreasing extra mortality in a class the mortality for which for all ages combined is the same as that of the classes considered which had an increasing hazard (namely, 140 per cent.) these ratios were arbitrarily adjusted so as to give a ratio of practically 140 per cent. for all ages combined but only 100 per cent. for age 60 on. The adjusted ratios chosen for this purpose are as shown in Table 9. *When "decreasing extra mortality" is mentioned hereafter, these arbitrary assumptions, chosen for purposes of illustration, are meant.*

8. Application of the Incidence of Substandard Mortality.

Premiums and reserves were now worked on several plans of insurance on five different assumptions of mortality incidence, using the AM(5) table as a standard:

(1) The assumption frequently made in practice that substandard mortality is a constant percentage of the standard, in this case 140 per cent.;
(2) The ratios shown in Table 1 for impairments with increasing extra mortality, adjusted so as to give a smooth progression of ratios;
(3) Decreasing extra mortality of the type exhibited by cases of family history of tuberculosis, the ratios being chosen somewhat arbitrarily, as explained above;
(4) Constant extra mortality of .005 to age 80;
(5) A series of ratios determined by an arbitrary combination of increasing, decreasing, and constant extra mortality, as explained below.

The percentages of standard AM(5) mortality used for assumptions (2), (3) and (5) were as shown in Table 9, intermediate ages being interpolated between those shown.

TABLE 9.

Percentages of AM(5) used for Theoretical Premiums and Reserves.

Age.	Increasing Extra Mortality.	Decreasing Extra Mortality.	Combined Extra Mortality.
30	137.5	250	140
40	137.5	200	140
45	143.75	175	140
50	150	150	142
60	150	100	146
70	125	100	123
80 and over	100	100	100

The figure of 140 per cent. used in assumption (1) represents the aggregate mortality ratio of business distributed in the same proportion as the original data of this investigation. Under a different distribution, this aggregate ratio would vary, although the ratios for the several attained ages should remain unchanged.

Inasmuch as most ratings in practice—except those for build—are based on the Medico-Actuarial aggregate ratios, the use of such a ratio in this connection seemed eminently suitable.

The assumption of constant extra mortality of .005 of course does not produce an average mortality ratio of 140 per cent. for the ordinary distribution of business, nor is it the constant extra mortality displayed by Table 7. It illustrates, however, the effect upon premiums and reserves due to this sort of impairment and illustrates the difference between forms of policy and between different ages more clearly than would the assumption of a smaller extra mortality. The relative effect is, of course, much the same.

The use of standard mortality above age 79 in the fourth assumption is arbitrary. The data at the high ages is insufficient to give any definite information. No attempt has been made to investigate any occupational classes supposed to be subject to an accident hazard, and the mortality assumptions to illustrate the effect of constant mortality have been made as simple as possible, the adjustment above age 79 being a concession to the general impression which is confirmed in general by figures in this paper, that the extra mortality disappears at age 80, all lives having practically the same degree of impairment after that time.

Occupational ratings are more often affected than physical ratings by the factor of the removal of rating. Most companies customarily remove an occupational rating upon change to a non-hazardous occupation either at the time of change or within two years thereafter, unless the risk has become badly impaired from a physical standpoint. The practice of removing physical impairment ratings is not so general and when practiced is subject to greater restrictions. In the case of constant extra mortality arising from occupation, unlike other substandard classes, the premium is generally payable, therefore, not longer than the existence of the impairment. The assumption chosen may accordingly be considered as an arbitrary limiting case. The figures based on assumption (3)—decreasing extra mortality—provide in a general way the lower limit.

Inasmuch as some companies treat all classes of impairments by the same method of rating, arbitrary ratios as shown in the last column of Table 9, representing the various types of extra

mortality properly weighted, were produced and applied to the calculation of premiums and reserves.

These arbitrary ratios were derived from the following fundamentals. The paper on "Ratings for the Principal Impairments" presented by Mr. Arthur Hunter and Dr. Rogers at the last meeting of the Society gives the impression that the impairments which generally involve a decreasing mortality percentage form perhaps one-sixth of the substandard business of the New York Life, occupations excluded, none of these impairments being among the first three, which were stated to be nearly one-half of the total, and such of these impairments as appear in the list given by Mr. Hunter and Dr. Rogers being scattered rather evenly throughout the list as it appears in order of importance. In the company with which I am connected the impairments which may be considered to occasion a decreasing extra mortality (tuberculosis, pleurisy, fistula, gastric ulcer, family history of tuberculosis, etc.) formed 22 per cent., by amounts, of the substandard business in force at the end of 1920 other than that rated by flat extra premiums (which were chiefly occupational cases). Inasmuch as the source from which this figure was drawn listed an impairment even though the applicant's age made it unimportant, and even though other impairments were found at the same time, a reduction should be made in the ratio, and probably 18 per cent. would not be far out of the way.

From these two facts it appears that while the relative amounts of substandard business with increasing and decreasing extra mortality (occupation cases being for the moment excluded) may conceivably vary between companies and between different periods of time, yet in current practice the latter may be taken as from one-sixth to 18 per cent. of the total of both types, or as from 20 per cent. to 22 per cent. of the former.

In the company with which I am connected, the business in force bearing flat extra premiums—almost entirely occupational cases—is about $\frac{5}{8}$ as large in amount as the cases of family history of tuberculosis, personal history of pleurisy, etc. They would therefore form 13 per cent. or 14 per cent. of the amount of the "increasing" cases, and the two types together—family and personal history, and occupational hazard—from 33 per cent. to 36 per cent. of the "increasing" cases.

If, however, the expected deaths in Tables 1 and 7, respectively,

are divided by the standard mortality rates for the several attained ages, the resulting exposure—which is not far from what would have been obtained had the exposures in the original data been grouped in the same manner as the deaths—shows Table 7, the "decreasing" classes, to have 37 per cent. of the exposure of Table 1, the "increasing" classes. So if we are willing to assume that the exposures where the hazard is from accidental death are distributed in the same proportions among the different age groups as those shown in Table 7 for the family and personal history impairments—not a hard assumption to make, since both types of application are most frequently presented at the young ages—we can get a fairly good practical expression for the incidence of all substandard mortality under modern conditions, by combining the mortality ratios in Tables 1 and 7, weighting each according to the expected deaths, which at any given age are obviously proportional to the respective exposures, and further weighting the ratios in Table 7 to allow for the fact that on the occupational cases the extra mortality is taken as .0032 instead of .002, this being roughly the net extra mortality involved in the flat extra premiums of the company with which I am connected, for a certain period in 1921.

The assumption that occupations involving the accident hazard show a constant extra mortality may be questioned. Mr. Moir's (*loc. cit.*) graph of the mortality among locomotive engineers showed a tendency for the extra mortality to increase for a time. The difficulties of investigating this subject, on account of the complications due to change of occupation, have been alluded to. I am informed, however, that the experience of a large accident insurance company on accidental deaths "at occupation" shows a mortality practically constant until after age 55. Above that age, the amount of exposure entering into the combined ratios is so small that considerable variations would change the ratios but little.

The weighted average, smoothed, appears in the final column of Table 9. It should be emphasized that the component figures are far from homogeneous, and that combined ratios will vary between different companies and different periods. The combination used, however, is based on one set of actual conditions, and with this understood, it may be of value in considering the application to those companies using one method of rating for all

substandard business, of what we have learned about mortality incidence.

Of the five assumptions, then, on which premiums and reserves were worked, the first is a practical method which is to be tested, the second and fifth are derived from the basic data, and the third and fourth are chosen arbitrarily for purposes of illustration.

9. Extra Premiums and Reserves.

Extra premiums and reserves on the various assumptions of substandard incidence are shown in Tables 10 and 11.

TABLE 10.

Extra Premiums over Standard AM(5) on Various Assumptions of Mortality Incidence—3½ Per Cent. Interest.

Age at Issue.	Ordinary Life.	10-Pay-ment Life.	20-Payment Life.	10-Year Endowment.	20-Year Endowment.	30-Year Endowment.
140% of Standard Mortality.						
30.....	$ 2.93	$ 5.01	$ 3.24	$0.91	$ 1.21	$1.64
40.....	4.41	5.95	4.20	1.38	2.11	3.08
50.....	7.47	7.72	6.56	2.99	4.78	6.58
60.....	13.73	11.57	12.45	7.33	11.42	
Increasing Extra Mortality.						
30.....	2.89	4.94	3.19	0.86	1.17	1.70
40.....	4.41	5.98	4.32	1.42	2.38	3.52
50.....	7.22	7.96	6.96	3.75	5.73	6.95
60.....	10.20	10.32	10.16	7.87	9.82	
*Decreasing Extra Mortality.**						
30.....	4.10	7.54	5.16	3.16	3.64	3.99
40.....	3.39	5.46	4.04	2.97	3.45	3.45
50.....	2.11	3.21	2.39	2.64	2.31	2.14
Constant Extra Mortality.						
30.....	3.76	6.81	4.60	2.50	2.95	3.30
40.....	3.63	5.54	4.01	2.52	2.99	3.35
50.....	3.55	4.41	3.61	2.58	3.11	3.45
60.....	3.53	3.63	3.49	2.72	3.35	
Combined Extra Mortality.						
30.....	2.74	4.72	3.06	0.91	1.21	1.67
40.....	4.02	5.51	3.95	1.39	2.18	3.20
50.....	6.46	7.09	6.21	3.23	5.08	6.20
60.....	9.35	9.49	9.32	7.22	8.99	

* Mortality assumed standard from age 60.

TABLE 11.

TERMINAL RESERVES ON VARIOUS ASSUMPTIONS OF MORTALITY INCIDENCE—3½ PER CENT. INTEREST.

Form.	Yrs., Duration.	Increasing Extra Mortality.	Decreasing Extra Mortality.	Constant Extra Mortality.	Combined Extra Mortality.	137 Per Cent. of Amer. Exper.	Amer. Exper. Rated 6 Yrs.	Std. Amer. Exper.	Std. AM (5).
Age 30 at Issue.									
O.L.	10	$142.25	$106.93	$116.19	$139.10	$119.19	$141.55	$110.14	$126.20
O.L.	20	315.79	267.45	268.51	310.81	280.03	321.80	258.64	285.60
20 P.L.	10	231.82	208.61	214.65	229.11	222.33	237.75	206.47	211.28
20 P.L.	20	550.26	517.45	527.18	545.66	555.25	578.13	508.49	502.45
20 End.	10	403.78	391.15	394.58	403.29	389.03	396.07	395.98	406.48
Age 40 at Issue.									
O.L.	10	202.34	158.71	172.32	199.43	182.60	209.98	166.89	182.42
O.L.	20	401.68	345.29	367.43	400.55	398.26	438.76	367.63	382.93
20 P.L.	10	291.13	258.26	268.10	288.40	277.25	297.44	261.10	270.43
20 P.L.	20	662.65	624.47	638.64	659.80	672.60	700.30	626.92	624.47
20 End.	10	405.97	392.26	395.62	405.15	390.23	397.66	396.66	407.24
Age 50 at Issue.									
O.L.	10	249.95	221.81	235.78	251.25	263.85	289.59	240.96	245.25
O.L.	20	458.39	462.16	464.74	461.15	520.12	551.10	485.23	478.36
20 P.L.	10	330.43	306.89	318.45	331.38	335.60	352.46	320.77	324.81
20 P.L.	20	756.40	740.46	746.90	755.17	786.57	810.62	746.98	740.46
20 End.	10	396.28	386.29	392.49	398.12	393.06	398.35	397.92	403.59
Age 60 at Issue.									
O.L.	10	277.87	Mortality	299.63	280.36	348.10	368.11	321.81	308.86
O.L.	20	510.46	assumed	543.03	514.61	626.88	681.96	597.84	560.25
20 P.L.	10	336.55	standard	354.52	338.65	382.15	390.02	369.84	362.65
20 P.L.	20	834.86	from	834.86	834.86	877.84	904.68	849.97	834.86
20 End.	10	366.43	age 60.	385.51	368.68	398.72	399.37	398.42	394.99

10. Relation of Theoretical Extra Premiums to Various Practical Methods of Rating.

In considering the relation of the schemes of extra premiums used in practice to the theoretical extra premiums herein developed we may well restrict ourselves to the system of rating by a special mortality table which is a constant percentage of the standard, inasmuch as the extra premiums for the rated age method and the method of rating by extra premiums which do not carry an increase in surrender values are derived primarily from consideration of what the extra premium would be on the percentage rating method.

The accuracy of the rated age method, as far as premiums are concerned, depends upon the degree of refinement used in determining the amount of rating up, which in turn is largely a matter of convenience. The arguments *pro* and *con* the rated age method are ably summarized in Mr. Hunter's paper (*T. A. S. A.*, XVI, 64) and the discussion thereon, and are not within the scope of the present investigation.

The companies using the percentage rating method customarily employ the percentages 125 per cent., 137½ per cent., 150 per cent., 175 per cent., 200 per cent., and sometimes higher. The gross extra premiums charged under this method will be found to be rather closely proportionate to the amount of the *extra* mortality percentage. That is, the extra premium for 150 per cent. mortality would be approximately ¼ greater than the extra premium for 140 per cent. mortality. Working along this line it appears that on *the assumption of increasing extra mortality,* the 137½ per cent. class would cover all forms and ages illustrated except that, as might be expected, the Endowments covering the period of the hump in the extra mortality curve would call for higher ratings, and the Ordinary Life rate at age 60, which applies to policies a considerable part of whose lifetime falls in the years of declining extra mortality, would call for a lower rating.

The premiums on *the assumption of decreasing extra mortality* call for a distinctly higher rating than 137½ per cent. at the younger ages and considerably less at the high ages. Companies which treat these classes of risk separately instead of subjecting them to the same treatment as all other substandard risks would

undoubtedly take this fact into consideration. I am not aware, however, that any company imposes higher ratings on Endowments forms than on Life forms, although a higher rating would theoretically be called for in the case of decreasing extra mortality, and at some ages in the case of increasing extra mortality. It is probably considered that the more favorable selection on the high premium forms, together with the fact that the actual monetary loss from an insufficient rating is small on these forms, offsets strict theoretical considerations.

The assumption of constant extra mortality shows results at the young ages similar to the assumption of decreasing extra mortality, but the effect does not disappear so soon at the high ages. This might be expected from the nature of the assumptions. The most interesting fact in connection with the premiums for constant extra mortality lies in the difference in amount of extra premiums as between forms of policy. Except for the 10-Payment Life form, which is not ordinarily a popular contract, the difference between forms is not marked. Many companies which use a flat extra premium for certain occupational hazards use an extra premium on 20-Year Endowment and higher premium forms which is $2.50 less per $1,000 than on lower premium forms. No such divergence is indicated by this investigation. If we consider the 20-Payment Life to be typical of the lower premium forms and the 20-Year Endowment of the higher premium forms and assume a non-participating loading of 10 per cent., then in the most extreme case, namely, at age 30, the Life rating would be $5.06 and the Endowment $3.25, a difference of $1.81. It might possibly be thought that the divergence between the theory as herein developed and the ordinary practice is possibly due to the assumption that the extra mortality remains constant to age 80. That this has no great effect is shown by some extra premiums which I had prepared in another connection on the assumption of American experience mortality increased by .005 at ages 25 to 55 and graded into the standard at ages 20 and 60 respectively. 3½ per cent. interest was used.

The resulting net extra premiums were as follows:

Age.	20-Payment Life.	20-Year Endowment
20	$3.94	$2.05
30	4.29	3.02
40	3.55	3.02
50	2.29	2.22

At least one company has taken cognizance of the fact brought out above by changing its scale of flat extra premiums so that the Endowment rating corresponding to a Life rating of $2.50 is $2.00, and that corresponding to a Life rating of $5.00 is $3.50.

The combined assumption of mortality gives rates which throughout are close to the 137 per cent. premiums except at age 60.

If all classes, except occupations subject to accident hazard, are handled by one method, the premiums will obviously lie between the "increasing" and the "combined" premiums, and will be close to the 137 per cent. premiums except at age 60.

11. Relation of Theoretical Substandard Reserves to Various Practical Methods of Valuation.

As to reserves, it appears that if we assume an average rated age of 6 years the reserves produced are adequate throughout. If the amount of rating is adjusted according to age rather than being based upon an average age, the reserve set up is in general higher at the low ages of issue and lower at the high ages of issue. The rating at age 60, however, would probably be at least 4 years, and a comparison of the standard American Experience reserves with the same reserves rated 6 years shows that a rating of 4 years would give generally adequate reserves.

The reserve on the basis of 137 per cent. of American Experience mortality is generally deficient when compared with the theoretical reserves required for increasing or combined extra mortality, but the deficiency is somewhat cut down when we recall that the theoretical reserves are based on $AM^{(5)}$ mortality and that the standard American Experience reserve is somewhat lower than the $AM^{(5)}$ standard reserve in most cases at the low ages.

12. General Consideration of Practical Methods of Rating.

The preceding sections have discussed the theoretical accuracy of separate phases of the prevailing systems of rating. It is now proposed to consider those systems as a whole, in the light of the information yielded by our investigation as to the incidence of substandard mortality, and the theoretical premiums and reserves derived therefrom.

From the facts brought out in this paper it appears that either *the percentage rating method or the rated age method,* which closely resembles it in many respects, is theoretically correct in the light of the actual incidence of mortality, with minor exceptions. It is true that the theory calls for a lower rating in some cases at the high ages, but this is offset in practice by the extreme adverse selection practiced by applicants at those ages. Consequently if a company applies one of these two rating methods to all its substandard business making no distinction as to the type of impairment, substantial equity is done to the rated business as a whole.

The same remarks apply *if occupational cases subject to an accident hazard are segregated and rated by a flat extra premium* without increase in surrender values, although as has been pointed out the prevailing adjustment of extra premiums between different forms of policy is open to some theoretical objection. It will be noted that the reserves on the assumption of constant extra mortality are higher than standard reserves on the 20-Payment Life plan at the twentieth year, and sometimes at the tenth. Since the extra premium over and above the Ordinary Life extra, which should in theory be collected to provide for excess mortality on fully paid policies, is not generally imposed in practice, there is no reason for granting increased surrender values.

Consideration of the table of reserves, however, shows that it is difficult to justify the use, for substandard business as a whole, of *extra premiums without increase in surrender values.* The statement sometimes made, that the rated age and percentage rating methods call for a higher extra premium than the method of extra premiums without increasing values, seems to have no particular justification when we are considering the entire class of substandard business. It is generally correct when applied to those

classes which show a constant extra mortality, including among these, if desired, risks with family history of tuberculosis and certain allied personal impairments which when taken together exhibit a practically constant extra mortality, as shown above.

Nothing has been said in this paper about *the lien method* for the reason that it is not available in the state of New York. It is not generally claimed of this method that it is particularly adaptable to substandard business as a whole. For risks with family history of tuberculosis and other impairments where the extra mortality decreases sharply the method is applicable provided that it is satisfactory to the policyholder to have his insurance decreased at the start when ordinarily he would need the maximum protection. If agency conditions will permit, the lien may well be made to run off at about the time when the effects of the impairment are expected to disappear from the class as a whole. This would mean around age 60 in the case of the group of family history impairments considered in this paper. A suitable method of determining the proper initial lien is given by Mr. Gore in his discussion of Mr. Hunter's paper (*T. A. S. A.*, XVI, 336). Consider, for example, an Ordinary Life policy to be issued with a lien to a class of risks whose mortality is that percentage of the standard which was assumed earlier in this paper to illustrate sharply decreasing extra mortality—namely, 250 per cent. at age 30, 200 per cent. at age 40, 150 per cent. at age 50, and standard at and after age 60. Suppose further that the Ordinary Life non-participating rate at age 30 is $18.18. Table 12 shows the mortality which according to Mr. Gore's method the liened policy would bear.

TABLE 12.

$1,000 Policy—Ordinary Life—Entry Age 30—Initial Lien $600—Reducing by Sum of Annual Premiums.

Policy Year.	Net Amount At Risk.—Am. Exp. 3½%.	Net Lien.	Net Claim.	Ratio of Lien to Net Claim.	Extra Mortality Assumed.
1.....	$990.55	$581.82	$408.73	142%	150%
11.....	876.80	400.02	476.78	84	100
21.....	724.50	218.22	506.28	43	50
31.....	544.15	36.42	517.73	7	0

The theoretical net premium for this coverage where the ex-

tra mortality is the indicated percentages of AM(6) and interest is taken at 3½ per cent. is $14.90. This compares closely with the AM(5) standard premium of $14.74.

13. Effect of Varying the Basic Rating According to Age at Entry.

Table 10 demonstrated that if all substandard business is rated in the same manner or if all cases except those subject to constant extra mortality are rated in the same manner, premiums based on the same percentage of extra mortality are indicated for all ages at issue, unless it is thought desirable to make a slight reduction at the highest ages. This would mean that a table showing the ratings to be imposed on various impairments in a company using the percentage rating method need not consider the factor of age. If the rated age method were used, any desired decrease of refinement could be employed. It is the practice of some companies, however, to increase the percentage rating according to age at entry in the case of certain impairments, such as heart murmurs. This would probably be indicated in those types of impairments where the curve of extra mortality shows a more noticeable hump than the average curve we have considered. It has been remarked that this condition would probably be found in classes where the average extra mortality for all ages combined is high. Under these circumstances, too, the short term Endowments would call for a distinctly lower percentage rating than the Life forms, up to perhaps age 50.

If a given company introduces any degree of refinements into its ratings it certainly is proper to give special treatment to classes where the percentage of extra mortality increases noticeably with age of entry. Otherwise, adverse selection would be not improbable. If this is done, however, special treatment of the converse type should be given to those classes where the average extra mortality decreases with age at entry, and this is in fact generally done by most of the companies which introduce refinements in the rating of heart murmurs, etc.

In this connection it should be noted that impairments which are of a quantitative nature permit of regrouping according to different standards and consequently different curves of extra

mortality by attained age. A qualitative impairment, such as a heart murmur, is of importance if it exists at all. Weight, on the other hand, is a property possessed by every applicant and becomes an impairment only when it exceeds or is in defect of a fixed standard. By making a suitable choice of this standard, the mortality ratios for various ages can be made to follow different lines of progression. It is well known, for example, that by grouping overweight applicants according to the excess of weight over the average for age 37, fairly constant ratios for all entry ages are obtained if the select period is considered together with the ultimate. Whether this feature would be shown when only ultimate mortality is considered is not certain.

14. Conclusions.

The facts brought out by this investigation confirm most of the impressions for which they are substituted. The Medico-Actuarial data indicates that for most classes of impairments the percentage of extra mortality is, at the young ages, a little below the aggregate ratio for all ages combined, and that it increases to a maximum somewhat above this aggregate ratio—the amount of increase varying with the severity of the impairment—, decreasing and falling below the aggregate in later life. Certain physical impairments show a decreasing percentage of extra mortality throughout life, and cases with tubercular family history show a sharper decrease, becoming standard by the time that age 60 is reached. If these two types with decreasing percentages of extra mortality are combined, the resultant extra mortality is nearly constant, although when expressed as a *percentage* of the standard it decreases with age.

The first-mentioned ("increasing") class is so predominant in the business of a company writing substandard business freely that its general tendencies, somewhat modified, are seen in combined mortality ratios, in which the various types of substandard mortality are brought together in approximately the proportions in which they are met in practice.

Premiums and reserves based on these studies in mortality incidence show that the principal methods of handling substandard business give results conforming rather closely to the theory except where no increase in surrender values is granted to any class of substandard business.

Finally, the arbitrary assumptions made for purposes of illustrating the operation of constant extra mortality and of rapidly decreasing extra mortality indicate the proper trend of extra premiums and of surrender values where these types of impaired risks are given special consideration rather than being rated in the same manner as all other substandard business.

Discussion of Preceding Paper.

(WRITTEN DISCUSSION.)

MR. A. A. RYDGREN:

Mr. Hoskins states on page 134 "Consideration of the table of reserves, however, shows that it is difficult to justify the use, for sub-standard business as a whole, of extra premiums without increase in surrender values"; and he formulates the conclusion "Premiums and reserves based on these studies in mortality incidence show that the principal methods of handling sub-standard business give results conforming rather closely to the theory except where no increase in surrender values is granted to any class of sub-standard business."

These statements are based on the assumptions, (1) that the Combined Extra Mortality ratios appearing in the last column of table 9 approximately represent the incidence of the mortality on the sub-standard business of any company freely accepting sub-standard business, and (2) that the duration of a policy has no influence on sub-standard mortality after the fifth year.

The Combined Extra Mortality ratios appearing in the last column of table 9 were obtained by combining the mortality ratios in Tables 1 and 7 weighting each according to the expected deaths and further weighting the ratios in Table 7 to allow for the influence of occupational cases. It is my understanding that the data entering into the composition of Table 1 comprises 1/1.37 or 72.99 per cent. of the data entering into the composition of Table 9. The mortality ratios appearing in Table 1, therefore, have a dominating influence on the Combined Extra Mortality ratios.

Table 1 is an aggregate table based upon the actual deaths and expected deaths between the sixth and twenty-fourth insurance years of a number of classes of impaired risks taken from Volume IV of the Medico-Actuarial Investigation. Such an aggregate table will produce correct reserves only if the mortality at any attained age is substantially the same for all insurance years from

the sixth upwards,—only if, for example, the mortality is the same during the twenty-ninth insurance year of a policy issued at age twenty-one as it is during the sixth insurance year under a policy issued at age forty-four. This does not appear to be true in respect of class 31-K, "pulse rate 90–100 at time of examination," and is certainly not true in respect of class 7-K, A, "albumin without examination for casts (at examination or within less than two years)." Indeed, according to the Medico-Actuarial Investigation of the latter class, the extra mortality diminishes very rapidly and disappears altogether after the tenth year.

The following table is illuminating:

Type of Impairment.	Percentage of Expected Deaths to Total Expected Deaths of Table 1.	Percentage of Expected Deaths to Total Expected Deaths Entering Into the Combined Extra Mortality Ratios Appearing in Table 9.
Albumin	1.85%	1.35%
Gall Stones	1.99%	1.45%
Bilious Colic	.58%	.42%
Articular Rheumatism	6.42%	4.69%
Stricture of Urethra	2.85%	2.08%
Syphilis	.81%	.59%
High Pulse Rate	2.70%	1.97%
Habits as to Alcohol	31.18%	22.76%
Overweight	51.62%	37.68%
Total of above classes	100.00%	72.99%

If the proportions in which the various major types of impaired risks enter into the total sub-standard business of a company, are substantially different from the proportions in which such types of risks enter into the composition of the Combined Extra Mortality ratios appearing in Table 9, then Mr. Hoskins's conclusions as to the reserves which should be held and the cash values which should be allowed under the sub-standard business of a company which treats all of its sub-standard business as one group, do not apply, and further investigation is necessary; and if it be shown that the proportion of those types of sub-standard risks showing constant or increasing percentages of actual to expected mortality as the duration increases is substantially less than the proportions of such risks entering into the composition of the Combined Extra Mortality ratios appearing in Table 9, and if the proportions of those types of sub-standard risks showing rapidly diminishing percentages of actual to expected mortality as the duration increases are substantially greater than the proportions in which such types of risks enter into the composition of the Combined Extra Mortality ratios shown in Table 9, then the theoretically correct reserve under the aggregate of the sub-standard business of a company will be substantially less than the reserve produced on the assump-

tion of the Combined Extra Mortality ratios, and may be even less than the corresponding standard reserve at true ages at entry. Mr. Hoskins refers to the major types of sub-standard risks comprising the sub-standard business of a company which freely accepts sub-standard business, arranged in order of their frequency; hence it will be interesting to ascertain whether the Combined Extra Mortality ratios appearing in Table 9 may be expected to reflect the incidence of the mortality of the sub-standard business of that company.

1. *Heart Murmurs.*—This class is not represented at all in the data entering into the Combined Extra Mortality ratios for the very good reason that this class was not investigated by the Medico-Actuarial Committee. Mr. Hoskins apparently assumes that this class will show an extra mortality increasing with the duration of the policy; but the only data I can find bearing on the question whether the percentage of actual to expected deaths increases or decreases with increase in duration is in Dr. W. A. Jaquith's discussion of Mr. Hunter's and Dr. Roger's paper—"Heart Murmurs —Their Influence on Mortality"; Dr. Jaquith's figures show that the percentages of actual deaths to the expected deaths according to the American Experience Table is very much less after the fifth year than during the first five years,—figures which appear to indicate mortality percentages diminishing with increasing duration.

2. *Overweight.*—This type of risk comprises 38 per cent. of the total data entering into the Combined Extra Mortality ratios. Entirely too much weight is given to this class, which is a class showing increasing mortality percentages.

3. *Albumin.*—This type of risk comprises only 1.35 per cent. of the data entering into the Combined Extra Mortality ratios. Not nearly enough weight is given to this class which is a class showing rapidly diminishing mortality percentages with increase in duration, the extra mortality apparently disappearing altogether after ten years.

These three classes form nearly one-half of the total sub-standard business of that company. If the percentage of actual to expected deaths in the "Heart Murmur" class and in the "Albumin" class diminishes with increase in duration—an assumption which, in the light of published statistics, appears to be the correct one—and if these two classes form so large a part of a company's sub-standard business, it follows that the theoretically correct reserve under the aggregate of the sub-standard business of the company will be very much nearer to if not actually less than the standard reserve at the true ages at entry.

Furthermore Mr. Hoskins has given entirely too much weight to the "Habits as to Alcohol" class—a class which comprises 23 per cent. of the total data entering into the Combined Extra Mortality ratios. Likewise he has given too much weight to the

"Rheumatism" and "Stricture of the Urethra" classes. According to the Medico-Actuarial Investigation, these three classes all appear to show constant or increasing percentages of actual to expected deaths with increase in duration.

It is therefore obvious that the proportions in which the various types of sub-standard risks enter into the composition of the Combined Extra Mortality ratios appearing in Table 9 are radically different from the proportions in which those types enter into the sub-standard business of that company,—so different that I venture the assertion that they do not represent the proportions in which the various major types of the sub-standard risks enter into the sub-standard business of any company which freely accepts sub-standard business. Entirely too much weight is given to classes showing mortality percentage constant or increasing with duration, and entirely too little weight is given to classes showing mortality percentages rapidly diminishing with increase in duration.

It can be demonstrated that (1) when the mortality rate is increased by a percentage which is constant or increasing as the duration increases, the policy reserve under a normal distribution of plans, ages, and durations, is increased, that (2) when the mortality rate is increased by a percentage which diminishes with increase in duration, the policy reserve is certainly not increased to the same extent as when the percentage is constant and may actually be diminished, and that (3) when the mortality rate is increased by a percentage which rapidly diminishes with increase in duration and which approximates zero by the tenth or fifteenth policy year, the theoretically correct policy reserve is actually diminished. As type (1) appears much less frequently and types (2) and (3) much more frequently in actual practice than assumed by Mr. Hoskins, the true reserve liability under the sub-standard business of a company freely accepting sub-standard business, is much less than that stated by Mr. Hoskins and may actually be theoretically less than the corresponding standard reserve at true ages at entry.

We need a good deal more information and of a different sort than that revealed by the Medico-Actuarial Investigation to determine whether a company, which freely accepts sub-standard business on the extra premium basis, should hold reserves on such business greater than the corresponding standard reserve at true ages. In the meantime our opinions will vary. My own opinion is that the aggregate theoretically correct sub-standard reserve does not exceed the corresponding standard reserve at true ages at entry.

(ORAL DISCUSSION.)

MR. ROBERT HENDERSON:

In the first place, I consider the thanks of the Society are due to the author of this paper for his very careful analysis of the subject. I do not feel, however, that some of the conclusions which might be drawn from this paper can be safely drawn on the strength of the amount of material covered. In saying so the point I have in mind at the present time is the one made regarding a decrease in the percentage of extra mortality at the old ages even in those classes which are assumed to be increasing. There are, it is admitted, certain classes in which that seems to be a feature of the experience.

I remember quite distinctly many years ago making some analysis of the experience of heavyweights in which that feature seemed to present itself, and it presents itself in the particular class of heavyweights used by the author of the paper as part of Table 1. As I recollect, it was a very marked feature of the experience in classes 2 and 3, B and C, when we analyzed our experience of that class. I am not so sure, however, but that it is a spurious appearance of decrease in mortality, and we certainly have never considered it safe to count upon it as an experience which would be realized on policies issued now at the younger ages and showing those impairments and continued in force, with the withdrawal selection which would be exercised against a company furnishing substandard business. That is a point that is to be remembered in considering this: that this is an experience on policies having that impairment but insured at standard rates, and there was no special incentive to withdrawal selection against the company. There will be where the company is charging an extra premium, and possibly allowing higher than the normal surrender values for surrender.

If a company wishes to operate on a safe plan with regard to these impairments, therefore, I am inclined to think they will calculate their net premiums on the assumption that the percentage of extra mortality shown by actual experience during the early policy years will pretty well persist as long as the policy is in force.

With regard to the opinion expressed by the author that he has divided extra risks into two fundamentally different classes—one class of increasing hazard showing a high mortality at the upper middle ages and a lower mortality at the young and old ages, and another class showing a decidedly decreasing mortality,—I would like to call attention to the fact that in Table 6 where he separates the classes of decreasing mortality, he separates them into two classes, one of Personal History and the other Family History.

and if you take the Personal History section and combine the mortality at 65 and over, you will find that the combined mortality at those ages is greater than the average mortality for all ages, so that that section of the decreasing mortality class does not seem to belong very decisively to that class. I, therefore, tried an experiment with his data. I took Table 2, which is his increasing mortality table excluding the liquor and overweight cases and combined it with the Personal History section of Table 6 and made an aggregate—simply added the two together and they ran as follows:

Attained Age.	Actual Deaths.	Expected Deaths.	Ratio Actual to Expected.
25 | 30 /	65	54.42	119%
35	135	106.27	127
40	212	147.43	144
45	237	171.23	138
50	235	184.28	128
55	234	170.07	138
60	200	144.14	139
65	155	112.64	138
70	89	74.55	119
75 and over	27	26.19	103
	1,569	1,191.22	134

The percentage of extra mortality on these combined classes keeps well up above the general average until you strike age 65, and you only strike a diminishing mortality risk at the older ages where the amount of exposure is small.

My only desire is to call attention as a matter of warning to these points which should be studied before the apparent conclusions of the paper are accepted without question.

MR. E. W. MARSHALL:

In glancing over this paper this morning one sentence caught my eye. "Nothing has been said in this paper about the lien method for the reason that it is not available in the State of New York." This sentence may be literally correct from one point of view, but as a matter of fact a company can, in effect, write policies with liens in the State of New York.

The New York Department will not allow policies to be written with a face value of say $1,000 with a provision for a lien in another section of the policy. The Department will, however, allow policies to be written for increasing insurance provided the amount of insurance for each policy year is stated definitely on the face of the policy in the space for the amount of insurance. For example, if it is desired to have a lien of $300 on a $1,000 policy, the

lien to decrease each year by a certain amount, the following phrase should be inserted in the space for the amount of insurance, "For the amount of insurance stated on the margin hereof," and on the margin of the policy the amount of insurance for each policy year should be definitely stated.

The lien method is, of course, very elastic. The lien does not necessarily need to be reduced annually by the premiums paid. If desired, without affecting the regular reserves on a policy, a lien may be imposed to cover exactly the expected extra mortality for each policy year. Hence, no matter what type of extra mortality is expected, whether increasing or decreasing, or constant for a period and then decreasing, it is possible to find a lien which will cover exactly from year to year the extra mortality expected. The amount of the lien is obtained by multiplying the net exposed to risk for any policy year by $K/(1+K)$, where K is the extra mortality to be covered during that policy year.

Of course on life policies, if the extra mortality is expected to be increasing or constant there would necessarily be a corresponding lien for the life of the policy. This would detract much from the salability of the policy and hence would usually be impracticable. The lien method is of particular value on endowment policies where the insured's attention is often focused on the old age benefits and he is willing to take the chance of having his insurance slightly reduced in the event of death before maturity. The method is also of use on life policies where the extra mortality will practically disappear in a reasonable number of years.

MR. M. M. DAWSON:

This paper very greatly interested me, Mr. President. It seems to me a very careful and painstaking study. The writer has gone over some of the same ground which I went over a few years ago and arrived at the same conclusions.

It seems incredible that we should believe, without proof, that extra mortality could be expressed by a percentage of normal mortality. The probabilities are so strongly against it that it would require demonstration before we could have a right to be convinced.

A priori, it is obvious that three kinds of extra mortality will be encountered, one, much the same as if the man really were older than the normal risk, meaning not merely that the risk of his dying is as much greater as it would be, were he a normal risk at the advanced age, but that this will continue true through the remainder of his life. Another, that the extra mortality would be nearly or quite constant without regard to age. A third, that the extra hazard is greater for a time and then gradually subsides. Persons who have suffered from zymotic diseases and have not completely recovered belong obviously in that class.

Investigation of the Medico-Actuarial experience and every

other experience shows that each one of these is present. It is possible that, as has been pointed out in previous meetings of the Society, there may be still other curves. Thus, there may be mortality increasing in intensity and when the period during which it would naturally be most intense has passed, gradually subsiding, although a priori it does not appear that this necessarily would be found. The other three one would a priori expect to find; it is no surprise that one does find them.

The chief reason why we have not dealt with the third form, *i.e.*, diminishing extra hazards, more adequately has been because we saw no way in which it could be done conveniently. But, there is a way: it consists in entering a conversion table with an annuity at a different rate of interest, the result of which is that the premium that you bring out provides for a steadily diminishing extra mortality. This can easily be done, and thus risks of that character may be rated adequately and fairly.

The proof of the applicability of the method is as follows:

Let $p_x =$ the probability of a standard life aged x years surviving one year.

$p'_x =$ the probability of an impaired life aged x years, the impairment reducing each year, surviving one year.

$$p'_x = 1-(q_x + rp_x)$$

i.e., representing the rate of extra mortality the first year by rp_x which, of course, can always be done. Then, simplifying:

$$\begin{aligned} p'_x &= p_x - rp_x \\ &= p_x(1-r) \end{aligned}$$

and we may assume, since the extra mortality gradually reduces and p_x also becomes smaller as the age increases, that for all subsequent ages

$$p'_x = p_x(1-r)$$

will hold.

Then

$$\begin{aligned} {}_np'_x &= p'_x(p'_{x+1})(p'_{x+2}) \cdots (p'_{x+n-1}) \\ &= (1-r)p_x(1-r)p_{x+1}(1-r)p_{x+2} \cdots (1-r)p_{x+n-1} \\ &= (1-r)^n p_x p_{x+1} p_{x+2} \cdots p_{x+n-1} \\ &= (1-r)^n {}_np_x. \end{aligned}$$

And since

$$\begin{aligned} a_x &= \sum_{n=0}^{n=\omega-x} v^n (1-r)^n {}_np_x \\ &= \sum_{n=0}^{n=\omega-x} (1+i)^{-n} (1-r)^n {}_np_x \\ &= \sum_{n=0}^{n=\omega-x} (1+i')^{-n} {}_np_x \\ &= \sum_{n=0}^{n=\omega-x} (v')^n {}_np_x, \end{aligned}$$

in which $(v')^n$ is discounted at a changed rate of interest which is found as follows:

$$\begin{aligned} v' &= v(1-r) \\ &= (1-d)(1-r) \\ &= 1-(d+r)+dr \\ &= 1-(d+r-dr); \\ \therefore d' &= d+r-dr, \\ i' &= \frac{d+r-dr.}{v'} \end{aligned}$$

That is to say, the value of an annuity, computed, say, at 3½ per cent. interest, on the impaired life with diminishing extra mortality may be represented by the value of the annuity by the standard mortality table, computed at a higher rate of interest, so arrived at.

And since

$$P_x = \frac{1}{a_x} - d$$

we may find the correct net whole life annual premium (or the single premium) at 3½ per cent. interest by entering Orchard's Conversion Table at the rate of interest 3½ per cent., with the annuity at age x, computed at this changed rate of interest.

It would be possible by this process to find the changed rate of interest corresponding with any reasonable value of r; but it is more convenient, in view of the tables available, to pursue the contrary policy and find the rate of initial extra mortality, thus diminishing, corresponding to changes of one-quarter or one-half per cent. in the rate of interest.

By the former process, the original rate of interest being 3½ per cent., it was found that the changed rates are as follows:

Let r =	Changed rate.
.0025	3.7594
.005	4.0201
.01	4.5455
.015	5.0761
.02	5.6122

By the latter process, it appears at once that at the usual ages at entry, say from 15 to 60, additions to the rate of interest at which the annuities are taken produce very nearly initial extra mortality equal to such change in interest rate, *i.e.*,

Increased Interest.	Approximate Initial Extra Mortality.
.0025	2.50 per 1000
.005	5.00 " "
.0075	7.50 " "
.01	10.00 " "
.015	15.00 " "
.02	20.00 " "

These extras hold pretty nearly level—*i.e.*, are little diminished—until age 60 is passed.

By the latter process, also the following approximate equivalents in initial percentage additions to the standard rate of mortality were found for the changes in the rate of interest given:

Increase of Rate of Interest.	Age at Entry.	Initial Increase of Mortality Rate.
.0025	30	30%
	40	25%
	50	20%
.005	30	60%
	40	50%
	50	40%
.0075	30	90%
	40	75%
	50	60%
.01	30	120%
	40	100%
	50	80%
.015	30	180%
	40	150%
	50	120%
.02	30	240%
	40	200%
	50	160%
.025	30	300%
	40	250%
	50	200%

This range appears to be quite as extensive as in any reasonable probability will be required. It would call for annuities of 3¾ per cent., 4 per cent., 4¼ per cent., 4½ per cent., 5 per cent., 5½ per cent. and 6 per cent., all of which by the American Experience Table are in existence, already computed, or are easily approximated by finite differences from other tables of annuities.

NET PREMIUMS AT 3½ PER CENT.

SHOWING NET ANNUAL PREMIUMS CORRESPONDING TO CHANGED RATES OF INTEREST 3¾ PER CENT., 4 PER CENT., 4½ PER CENT., 5 PER CENT., 5½ PER CENT. AND 6 PER CENT., COVERING INITIAL EXTRA MORTALITY, RANGING FROM 20 PER CENT. TO 300 PER CENT.

Net Annual Whole Life Premiums Corresponding to Changed Rates of Interest.

Age.	3¾%.	4%.	4¼%.	4½%.	5%.	5½%.	6%.
20	$15.40	$17.31	$19.26	$21.22	$25.15	$29.12	$33.16
21	15.69	17.60	19.52	21.46	25.39	29.36	33.34
22	15.99	17.89	19.80	21.74	25.67	29.60	33.62
23	16.31	18.10	20.09	22.05	25.85	29.84	33.84
24	16.64	18.51	20.41	22.33	26.21	30.12	34.07
25	16.97	18.84	20.74	22.68	26.53	30.41	34.35
26	17.34	19.21	21.10	23.00	26.86	30.74	34.68
27	17.73	19.60	21.46	23.36	27.20	31.08	34.96
28	18.13	19.98	21.86	23.76	27.57	31.42	35.29
29	18.57	20.41	22.27	24.16	27.95	31.80	35.63
30	19.01	20.86	22.71	24.60	28.37	32.19	36.02
31	19.49	21.31	23.16	25.04	28.80	32.59	36.41
32	20.01	21.83	23.66	25.50	29.24	33.03	36.86
33	20.53	22.33	24.19	26.02	29.72	33.48	37.31
34	21.10	22.91	24.73	26.53	30.25	33.98	37.77
35	21.71	23.49	25.32	27.12	30.78	34.49	38.28
36	22.33	24.12	25.96	27.72	31.37	35.06	38.81
37	23.00	24.77	26.81	28.37	32.02	35.68	39.39
38	23.72	25.46	27.31	29.04	32.67	36.31	40.04
39	24.46	26.21	28.03	29.76	33.39	37.01	40.70
40	25.25	27.01	28.76	30.52	34.12	37.73	41.43
41	26.10	27.84	29.56	31.37	34.96	38.54	42.17
42	27.01	28.72	30.41	32.23	35.77	39.39	42.99
43	27.95	29.68	31.33	33.16	36.71	40.31	43.88
44	28.96	30.70	32.37	34.17	37.66	41.26	44.80
45	30.04	31.76	33.48	35.25	38.75	42.29	45.80
46	31.20	32.90	34.68	36.36	39.88	43.40	46.89
47	32.45	34.17	35.92	37.56	41.03	44.62	48.08
48	33.75	35.44	37.26	38.86	42.35	45.87	49.31
49	35.15	36.86	38.60	40.26	43.70	47.22	50.64
50	36.66	38.33	40.04	41.71	45.17	48.62	52.10
51	38.28	39.93	41.60	43.29	46.70	50.15	53.60
52	39.99	41.60	43.29	44.99	48.42	51.80	55.23
53	41.77	43.46	45.11	46.76	50.15	53.60	57.01
54	43.70	45.36	47.03	48.69	.10	55.47	58.86
55	45.80	47.42	49.10	50.79	54.14	57.51	60.08
56	47.95	49.66	51.29	52.99	56.27	59.64	63.08
57	50.29	52.02	53.67	55.31	58.97	61.97	65.39
58	52.84	54.52	56.19	57.84	61.15	64.42	67.81
59	55.55	57.18	58.86	60.52	63.84	67.09	70.46

NET PREMIUMS AT 3½ PER CENT.—CONTINUED.

Age.	3¾%.	4%.	4¼%.	4½%.	5%.	5½%.	6%.
60	58.44	60.08	61.70	63.37	66.69	70.03	73.37
61	61.60	63.18	64.80	66.49	69.81	73.14	76.44
62	64.90	66.49	68.12	69.81	73.02	76.44	79.69
63	68.43	70.03	71.67	73.25	76.56	79.95	83.14
64	72.23	73.83	75.47	77.05	80.34	83.69	86.96
65	76.32	77.92	79.56	81.13	84.39	87.84	90.87

NET PREMIUMS 3½ PER CENT. STANDARD.

Single Premiums, Whole Life, Corresponding to Changed Rate of Interest.

Age.	3¾%.	4%.	4¼%.	4½%.	5%.	5½%.	6%.
20	$312.85	$338.55	$362.90	$385.56	$426.47	$462.66	$495.12
21	316.91	342.27	365.94	388.26	428.84	464.69	496.47
22	320.97	345.99	369.32	391.30	431.55	466.71	498.50
23	325.36	349.71	372.71	394.69	433.24	468.74	500.19
24	329.76	352.77	376.43	397.73	436.62	471.11	501.88
25	334.15	357.83	380.14	401.45	439.66	473.48	503.91
26	338.89	362.22	384.20	404.83	442.71	476.18	506.28
27	343.96	366.96	388.26	408.55	445.75	478.89	508.31
28	349.03	371.35	392.66	412.95	449.13	481.59	510.68
29	354.44	376.43	397.05	416.67	452.51	484.64	513.04
30	359.86	381.50	401.79	421.06	456.23	487.68	515.75
31	365.60	386.57	406.52	425.46	459.95	490.72	518.45
32	371.69	392.32	411.59	429.86	463.67	494.11	521.50
33	377.78	397.73	417.00	434.93	467.73	497.45	524.54
34	384.20	403.82	422.42	439.66	472.13	501.21	527.58
35	390.97	409.90	428.16	445.07	476.52	504.93	530.97
36	397.73	416.33	434.25	450.48	481.26	508.99	534.35
37	404.83	422.75	440.34	456.23	486.33	513.38	538.07
38	412.27	429.52	446.76	461.98	491.40	517.78	542.13
39	419.71	436.62	453.19	468.07	496.81	522.51	546.18
40	427.49	444.06	459.61	474.49	502.22	527.58	550.58
41	438.99	451.50	466.38	481.26	508.31	532.66	554.98
42	444.06	459.28	473.48	488.02	514.06	538.07	559.71
43	452.51	467.39	480.92	495.12	520.48	543.82	564.78
44	461.30	475.85	489.03	502.56	526.91	549.57	569.86
45	470.43	484.30	497.49	510.34	534.01	555.65	574.27
46	479.90	493.09	506.28	518.12	541.11	562.08	581.01
47	489.71	502.56	515.07	526.23	548.21	568.84	587.10
48	499.52	511.69	523.86	534.69	555.99	575.60	593.19
49	509.66	521.50	533.00	543.48	562.77	582.71	599.61
50	520.14	531.30	542.13	552.27	571.88	589.81	606.38
51	530.97	541.45	551.59	561.40	580.00	597.25	613.14
52	541.79	551.59	561.40	570.87	588.79	605.02	620.24
53	552.61	562.42	571.55	580.34	597.25	613.14	627.68
54	563.77	572.90	581.69	590.14	606.38	621.26	635.12
55	575.27	583.72	592.17	600.29	615.51	629.71	642.90
56	586.43	594.88	602.66	610.43	624.64	638.16	651.01
57	597.92	606.04	613.48	620.58	634.44	646.96	659.13
58	609.76	617.20	624.30	631.06	643.91	655.75	667.25
59	621.59	628.36	635.12	641.55	653.72	664.88	675.70
60	633.43	639.86	645.94	652.03	663.53	674.35	684.49
61	645.60	651.35	657.10	662.85	673.67	683.82	693.29
62	657.44	662.85	668.26	673.67	683.48	693.29	702.08
63	669.28	674.35	679.42	684.15	693.62	702.75	710.87
64	681.11	685.85	690.58	694.98	703.77	712.22	720.00
65	692.95	697.34	701.74	705.80	713.91	722.03	728.79

The investigation made by me of the facts reported in the Medico-Actuarial investigation, and also in connection with the experience of several companies in regard to extra mortality, arranged under different heads, showed that as regards 11 impairments out of a list of 37, the extra mortality was of the improving type; as regards no less than 20 out of 26 places of residence; as regards 14 out of 56 occupations, and as regards 10 out of 15 family histories, that is, taking them altogether, in no less than 55 out of 134. From this it appears that this method of rating may have great possibilities of usefulness.

Were there no statistics on the subject it would be clear a priori that as to most of the physical impairments where it is applicable, it would be so. As regards residence the same thing would be expected because as one becomes thoroughly acclimated the hazard will diminish. It might not be expected that the same thing would be found in occupations and yet when one considers that the extra hazard in cotton mills, distilleries, glass blowing and several other classes, is of precisely the same sort as the climatic or residence extra, viz.: that one may become inured to it and thereby more capable of resisting, it is obvious that the same thing is reasonably to be expected. Certainly it is peculiarly to be expected as regards a family history of consumption. That has long been recognized and the facts indicate that it is also true of family history of heart disease or apoplexy.

The most successful work, the results of which have been made public so far, was the rating up in age by the Australian Mutual Provident Society; its experience at the rated-up ages was about 66 per cent. of the expected at those ages according to the H. M. table, while its experience on lives accepted as first class was about 64 per cent. But it should be remarked that the rating which showed that admirable result was virtually submitted to an investigation largely of what you may call junior risks; the favorable experience, therefore, may not mean that through the entire life of these risks an increasing mortality represented by a rating-up would be encountered. This does not follow from the fact that for the time during which the policies have been in force, the mortality was within the expected by about the same percentages as risks accepted as first-class.

There is the same difficulty regarding comparison of actual to expected under the methods of rating now in use here. They only show that for the relatively short periods the policies have been in force, these methods of rating have yielded satisfactory results; one cannot certainly know that the experience already had means that the experience for the future under the same policies will be satisfactory.

MR. J. F. LITTLE:

This question of the incidence of extra mortality has given me a great deal of anxious thought from time to time. It seems to me that instead of there being merely three types of extra mortality there are probably 300 or 3,000 types. Of course, we group them into three standard forms: the decreasing, typical of which is family history of tuberculosis; the constant, which might be represented by an occupational hazard; and the extra mortality that is increasing, such as that incident to overweight.

The company with which I am connected writes Intermediate policies for $500 each, under which form of policy many occupations are acceptable (on account of the higher premium rate charged) that would not be accepted at standard rates for our regular policies. Some time ago I looked into some of the older business issued prior to 1907. I was curious to see how the extra mortality persisted. There was a good deal of extra mortality, but on the figures, as I had them, there was none after age 65—that is, compared with the same company's standard policies. It is, of course, quite likely that a fuller investigation would reveal some extra mortality existing after that age. I think the two or three years I looked at were perhaps affected by a favorable accidental fluctuation. But there appears no question but that in the case of health-affecting occupations as a whole, after the occupation is finally retired from, and notwithstanding the accumulated ill effects of such occupation, the remaining extra mortality is relatively slight. The only reason I can offer is this: that of men in these hazardous, wearing occupations, the survivors at age 65 really represent those who at the start were more vigorous than the average. Less vigorous men will survive to age 65 in a bank than will in a steel mill; with the result that the surviving steel workers, being originally more vigorous on the average than the surviving bank clerks, from 65 on may show quite as low mortality. This does not mean that they have not suffered from the hazards of occupation. Had they not done so, their mortality would be superior to that of the bank clerks as they are, by hypothesis, on the average of a more vigorous type originally.

In dealing with the extra mortality by age, where we apprehend an increasing mortality, it is never, I believe, at the higher ages an increasing *percentage* of the standard mortality, because that means such a tremendously rapid growth of actual increase in mortality. In these cases I think we ought to draw a distinction. If we are insuring men, say, at ages between 60 and 65, we have to bear in mind that the selection on the part of the insured is very much more decided than it is at younger ages, and if we are considering the mortality at ages between 65 and 70, incident to some particular impairment, we would find, I think, something very different in the case of those insured between ages 60 and 65,

after the period of selection is past, from what we would expect to find in those insured 25 or 30 years earlier. My reasoning is something after this fashion: if we select a group—and, remember, our groups are never homogeneous—we select them on the evidence as presented to us in the applications and the medical reports, with the result that we put into a group supposed to be suffering from a certain impairment some who probably are not suffering from the impairment at all. Also there are some who will eventually overcome the impairment and become quite well again, and some who, although the impairment may never be overcome, will still develop such powers of adjustment that the impairment will have very little effect on their future lifetime.

Now, among men who have been insured for a long period, this process has been going on for a considerable time, and those who were really seriously affected by the impairment have to a large extent died off. Those who have withstood the impairment for a long period of years have indicated that either the impairment in their case was not so important as in other cases or that their initial vitality was greater. Consequently, among persons entering, for instance, at ages between 25 and 30, subject to an impairment of the increasing extra mortality type, I believe we would find the curve of extra mortality to rise for a time and then to fall rather decidedly. But if we take merely the ultimate experience of persons entering at all ages, omitting the first five years, we may not have that appearance in the resulting table of mortality; we may have an experience of extra mortality apparently rising for a longer period than it really does.

MR. FRANKLIN B. MEAD:

The first thing that occurs to me in reading this paper is: what is ultimate mortality on sub-standard business? In many of the types the highest mortality is about the second or third year. Our own experience—we have been accepting several thousand risks yearly for the past few years—is that we reach our ultimate or highest mortality in about two years. The mortality the first year is very, very low, and after that, so far as our experience goes, it is practically a constant extra percentage.

Now take the decreasing risk, such as the Consumptive Family History; what is ultimate mortality? If you cut out five years you are cutting out the most critical period and that would be true also of many medical impairments. Is there then any real ultimate mortality—that is, where you can group for purposes of investigation risks by attained age and hope to get the same rate of mortality for attained age no matter what the time of entry may be?

As has already been intimated in the discussion, are the classes in the Medico-Actuarial Investigation really sub-standard classes?

Take some of the groups that the author has taken for the subject of his paper: 7-K and A, for instance, Albumin without Examination for Casts. If I remember correctly, there were some extra deaths from Nephritis in that group, but if we consider the group as a whole and the method in which they were selected, it is quite probable that the albuminuria in about 80 per cent. or 90 per cent. of them was not of any significance, and the companies, believing there was significance in that albuminuria, exercised super-selection. Probably the large bulk of them were super-standard risks, possibly 80 per cent. risks.

Take Group 12—A, B, C, D and J, Gall Stones and Bilious Colic, attacks at any time—after a few years most of those cases are usually accepted on a standard basis. The question is whether this may be considered a typical sub-standard group and whether the combination of the groups selected may be considered typical.

Referring to Table I and glancing down the extra percentages of mortality, it will be seen that there is practically a constant extra percentage of mortality up to 65 or 70 and this demonstrates, if these groups are of significance at all, that the mortality of sub-standard business is a constant extra percentage. One hundred forty per cent., the total for the group, is deviated from in a favorable way beginning at age 70 only.

Referring also to Table VI, the mortality in that table is really a constant mortality of about 125 per cent. for practical purposes, it seems to me. Then referring to Table VII, where the extra mortality is a constant—is not that due to the composition of the table? It will be recalled that the author has included in that table those who had a personal history of pleurisy and those who had tuberculous family history with a certain amount underweight at ages up to 29, and with a greater amount of underweight at ages above 29, from 30 to 39. Isn't that exactly what you would expect, if you should decrease the weight with age with the impairment of a consumptive family history? Looking at it in a reverse way, if you took overweights—the mortality on overweights being an increasing percentage with increasing age—if you took overweights between ages 50 and 60, 20 pounds overweight, between 40 and 50, 35 pounds overweight, between 30 and 40 a still greater amount overweight and under 30 a still greater amount overweight, wouldn't it be quite easy to prepare a table which would show a constant extra mortality, and would that table demonstrate anything?

Referring again to Table IX, the first column, that for all practical purposes is a constant extra percentage table, it is only up above age 60 that that type of mortality—and that is not greatly significant—is deviated from, and if you will refer to the table of premiums and reserves you will find that the assumption of a constant extra percentage is indicated as a near reflection of the conditions of Mr. Hoskins's data.

I am merely bringing these points out to question whether the investigation is at all conclusive. The paper is one of the most interesting presented to the Society in recent years. I think its greatest importance is that it stimulates thought. It is very carefully prepared, and should be the precursor of other papers on the same subject. This is one of the most important subjects, I think, we have before us at the present time.

MR. C. D. RUTHERFORD:

The Author has only referred, in passing, to the lien method, and I think there is a certain amount of misunderstanding in regard to the importance of the lien that is usually imposed on policies. In the case of decreasing extra mortality, at age 30 the ordinary rule for calculating a lien, assuming that the reserves are to be left unaltered, gives a 60 per cent. lien, which, in practice, would be decreased at the rate of 2 per cent. per annum. If the extra premium found by the Author is charged, and the total amount paid for premium by the assured is left unaltered, the amount of insurance would be permanently decreased by 23 per cent. From this point of view the 60 per cent. lien is not so serious as might at first sight appear. In practice I may say, it is not unusual for an agent to induce an applicant to take out additional assurance to cover at least part of the difference between the original amount applied for and the amount after deduction of the lien.

The other point is one which has not really been given sufficient attention in the past, and the Author has not touched on it at all. In the first few years after issue, in types of risk subject to a decreasing percentage of extra mortality, the additional mortality is liable to be very heavy indeed, and it is quite possible if an extra is charged that the annual premium is not sufficient to provide both for the cost of insurance and the normal expenses of the business. In the case just cited the mortality cost at age 30 is approximately $11.00 per $1,000.00, while the first-year premium on the Illinois Standard on a Whole Life policy is less than $9.00 assuming that the entire extra is added to the first-year premium. In other words, if policies of this type are dropped a few years after issue there may be a definite loss to the Company on their issue.

MR. HENRY MOIR:

Reference was made to the rated age method of treating substandard business, and it seemed to be assumed that that method implied the same number of years addition irrespective of the class of policy. Now that is not necessarily the case, and some companies do impose different ratings according to the kind of policy placed. Of course, there is no reason why that distinction

should not be drawn. The rating on a 20-Year Endowment policy ought to be much more at young ages when expressed as an addition to the age than on an Ordinary Life policy.

The question of a decreasing and an increasing mortality is one which, as Mr. Rutherford pointed out, needs a good deal of consideration. The decreasing mortality question is one which actuaries have had in mind in the past, because it results in this: that some of the members of the group who are treated as sub-standard recover and become standard risks, while others probably remain in their sub-standard condition. Those that recover, under our present surrender value laws, can demand that thereafter they be treated as standard risks; otherwise they surrender their policy and take out new insurance. Accordingly, in handling that group it is necessary to impose a larger extra in the first place than theory would seem to require. In handling the other group, the group that shows an increasing mortality, it may be possible to act in a more nearly theoretical way, because if there is a degenerative tendency, the members will not be able to select against the company to the same extent that the other group can.

With reference to the lien method, the first speaker referred to the New York law, and I think he referred to it correctly: that if we express the policy as an increasing policy and give a schedule of the sums insured, the lien method is still permissible under the New York law. If the lien method be applied to endowment policies, it will be found quite suitable. It is not an elastic method when applied to ordinary life policies, but even with endowments running for 30 and 35 years, it will be found that this lien method is quite flexible. I have referred to this and discussed it pretty fully elsewhere—*T. A. S. A.*, Vol. XVI, p. 345.

(AUTHOR'S REVIEW OF DISCUSSION.)

MR. JAMES E. HOSKINS:

The attention accorded this paper by eminent Actuaries who have given special attention to the subject of sub-standard insurance is very flattering. The paper was written with the expectation that any value it might possess would derive from the questions it raised rather than from the conclusions it reached; that, in Mr. Mead's words, it would "be the precursor of other papers on the same subject." This hope has been realized in that at least three interesting questions have been brought out in the discussion:

1. Mr. Henderson raises the question whether the mortality rates shown drawn from the Medico-Actuarial data, which included largely risks insured at standard rates although found on subsequent investigation to be sub-standard, would not differ from the mortality rates on similar classes insured at sub-standard rates with special surrender values, on account of withdrawal selection against

the company. It is superfluous to remark that when we have accumulated enough experience on lives insured at sub-standard rates to justify an investigation of the incidence of the extra mortality, the results will be more reliable than those developed in this paper. I have merely attempted to analyze what data we have and see what tendencies are indicated.

It might be argued that any loss on account of withdrawal selection should be paid by the withdrawing policyholders in the form of a surrender charge. This is part of the fundamental theory of surrender values; and where surrender charges have been abolished on standard policies it is because of a belief that there is practically no withdrawal selection. If the withdrawal selection is paid for by the withdrawing policyholder then the extra premium should be based on pure mortality rates into which lapsation does not enter. Of course it is not always practicable to impose higher surrender charges on sub-standard business than are imposed on standard business.

2. Mr. Mead raises the question—"What is ultimate mortality on sub-standard business?" The assumption was made in the paper that impaired risks would exhibit the same characteristic as standard risks—namely that after the first five policy years have elapsed the mortality is practically independent of duration. Whether any or all types of impaired risks will exhibit this characteristic and whether different select periods will be found for different types of impairments is a matter for future investigation.

3. The most serious question is that raised by Mr. Rydgren,—whether in the substandard business commonly written today there is a predominance of the classes with increasing extra mortality. On this hinges the question of the proper method of treating surrenders of sub-standard policies, and we cannot be content to allow this to remain as a difference of opinion. If one agent is told by his Actuary that the method of extra premiums without increased surrender values is scientifically correct, while his competitor learns on equally good authority that the method of increased premiums with increased values is supported by cold facts, the result will not be conducive to confidence in actuarial science. There may be room for the two methods as a matter of business policy; but we cannot always continue to endorse both as scientifically correct.

Mr. Rydgren's argument resolves itself into the question of whether heart murmurs and albuminuria fall in the class with increasing extra mortality or not. The evidence he adduces to place them in the class of decreasing extra mortality is too small to be convincing. I believe that the idea of placing them there might fairly be called a surprise to many insurance men. At least Mr. A. B. Wood said a few years ago (*T. A. S. A.*, XIX, 119): "The general opinion of medical men is that the effect of albuminuria and of glycosuria is to produce an increasing rate of extra

mortality." Moreover, whatever else may be said of these impairments, they certainly do not resemble, by causing a high mortality at the young ages, the impairments whose decreasing nature is unquestionable. It may be, however, that an extensive investigation of these classes would show a distinctly decreasing tendency or that as Mr. Dawson suggests there may be a fourth type of incidence—namely, mortality increasing in intensity for a short time and gradually subsiding when the period during which it would naturally be most intense has passed.

In addition to these three questions, the discussion brings out interesting suggestions for the practical treatment of rated applications. Mr. Mead, speaking of the results in Table 7, in which the ratios of actual to expected deaths among certain classes of risks with generally decreasing extra mortality percentages are shown to be approximately equal to the ratios produced by increasing the standard rate of mortality by .002, expresses the opinion that similar results can be obtained in connection with any other impairment which can be measured quantitatively, such as overweight. This is true, however, only under certain assumptions as to the distribution of ages at issue. For instance, suppose that a group is formed, as Mr. Mead suggests, by taking applicants of 20 lbs. overweight between ages 50 and 60, 35 lbs. overweight between 40 and 50, etc. Considering applicants entering at, say, 35, the ultimate mortality percentage will be at least as high at 50 as it is at 45 (probably a little higher). But if the extra mortality is to be expressed as a constant addition to the standard the ratio at 50 must be less than it is at 45 (see the last column of Table 7). In order to accomplish this there must be a sufficient number of entrants at 40 and above of the proper degree of overweight. Otherwise the ultimate mortality of the class thus arbitrarily formed must increase rather than decrease. I am not so sure that the ratios in Table 7 depend on this factor. I am inclined to think that any one of the component classes, if present in volume large enough to give a smooth curve, would show much the same tendencies as the aggregate of the group.

Mr. Dawson gives an instructive method for computing extra premiums on risks with decreasing extra mortality. The method depends upon the assumption that the extra mortality may be expressed approximately as a constant multiple of the probability of living. That this is a reasonable assumption in some cases is shown by the following table in which mortality ratios expressed as a percentage of the standard are shown, first on the basis of the $AM^{(5)}$ table with $r = .002$, and second as shown in the last column of Table 7, which may be considered as a graduation of the next to the last column in that table.

Attained Age.	Percentages of Standard Mortality. Mr. Dawson's Method.	M. A. Data Smoothed.
25	146%	143%
30	145	141
35	142	139
40	134	135
45	125	127
50	117	119
55	111	113
60	107	108
65	105	105
70	103	103
75	102	102
80	101	101
85	101	101

The method does not give so close a fit to the series of decreasing extra mortality percentages shown in Table 9, which are an arbitrary adjustment of Table 8. With r chosen as .006 the fit is close at the middle ages but not at the extreme ages.

Attained Age.	Percentages of Substandard Mortality. Mr. Dawson's Method.	Table 9.
30	234%	250%
40	202	200
45	175	175
50	151	150
60	122	100
70	109	100
80	104	100

The closeness of the fit in the former case is largely due to the fact that at the young ages a constant percentage of the probability of living is itself nearly constant, while at the higher ages the ratio of the extra mortality to the standard mortality is so small that no great variation is possible. The method, therefore, gives best results where the extra mortality is nearly constant in amount. From this it might be expected that the extra premiums produced would be nearly constant, and this is found to be the case. The excess of the Ordinary Life premiums corresponding to 4 per cent. interest in Mr. Dawson's table over the standard American Experience 3½ per cent. premiums is as follows:

Age.	Extra Premium.
30	$3.67
40	3.51
50	3.34

A similar study of the AM[5] 3½ per cent. table for a value of $r = .005$ gave the following approximate Ordinary Life extra premiums:

Age.	Extra Premium.
30	$3.60
40	3.45
50	3.35

For the class of risks, therefore, to which the method is best suited, it has no great theoretical superiority to the more convenient method of flat extra premiums independent of age.

Any attempt to determine proper extra premiums for risks with decreasing extra mortality should, of course, as Mr. Rutherford points out, consider the heavy extra mortality in the early policy years, as well as the ultimate mortality.

I wish especially to express my thanks to those members who supplemented my rather scanty references to the lien method.

Notes on the Actuarial Requirements of the Insurance Act of Canada in Respect of Friendly Societies—History and Present Status.

BY

A. D. Watson.

An Amendment to the Insurance Act, 1917, was passed in 1919 affecting friendly societies. There are now eight Canadian societies and eleven United States societies subject to the provisions of this Amendment, and the affairs of each society is reported on annually by a Fellow of this Society, of the Institute of Actuaries, or of the Faculty of Actuaries. There is reason for thinking that the provisions of the Amendment are not so widely known as may be desirable. Perhaps, therefore, a brief discussion in the pages of the *Transactions,* from the actuary's point of view, may serve some useful purpose.

These notes may seem rather belated, seeing that the Amendment came into effect over two years ago, but possibly a clearer view may now be had of the purport of the measure than at an earlier date.

Before dealing with the present status of friendly societies, it will be helpful to review briefly, and in a general way, the legislative development as respects friendly societies up to the passing of the Amendment. This relates wholly to Canadian societies, but is of more importance and significance than the number of societies would suggest.

In 1885 was passed an Act (48 and 49 V., C. 49) to modify the application of the Consolidated Insurance Act of 1877 (40 V., C. 42) with regard to companies transacting life insurance on the assessment plan. Friendly societies were exempt from this Act unless permitted, on application, to come under its provisions. The exemption clause appears in the Insurance Act until 1906. A brief statement of the provisions of the Act originally intended to apply to assessment companies, but later applied to friendly societies, will help to give a better idea of the friendly society situation when the 1919 Amendment was passed.

These provisions were as follows: A license deposit of $50,000 was required. Death benefits were the only benefits contemplated, and these were to be a first charge on all assessments received therefor. Provision was required to be embodied in policies for the making of sufficient assessments to pay all claims in full. The words, "This association is not required by law to maintain the reserve which is required of ordinary life insurance companies," were required to be printed in every application and policy, and the words, "assessment system," were required to be printed on every policy, application, circular, or advertisement in respect of the business.

While the above are the main special provisions of the Insurance Act which became applicable to friendly societies, and continued to apply to them until the end of 1919, each society was in addition subject to the provisions of its Act of Incorporation; but the earlier acts apart from stating the fraternal objects of the societies, can hardly be said to have contained any provisions designed with special reference to fraternal insurance business. At a later stage some societies sought an extension of charter powers to include sickness, or sickness and funeral benefits; and in granting these wider powers, reserves were required to be maintained on a 3½ per cent. basis, and, in respect of sickness benefits, such standard tables of sickness as were used in the calculation of contributions; but contributions do not seem to have been based on any sickness tables, standard or otherwise.

Later still new societies were incorporated by special Act of Parliament, and in each case provision was made for maintaining reserves for all mortuary, sickness, and other benefits. The rate of interest to be used, or the maximum limit 3½ or 4 per cent., was prescribed. In some cases the rate of mortality was also prescribed, but tables of sickness and other contingencies were left to be decided on by the Superintendent of Insurance. One society obtained a Federal Charter in 1898 in which it was required, in respect of new life business, to maintain the same reserve as old line companies, while the old mortuary business was to continue on the old basis. Another society at a later date, by an enabling amendment to its charter, readjusted its mortuary business, being thereafter required to maintain reserves in accordance with its own experience. The remaining societies, although not obliged to do so by law recognized the wisdom of doing business on a sound

basis and had readjusted their mortuary business prior to 1915. With one exception the readjustments effected solvency. The societies which had readjusted voluntarily were not subject to any reserve restrictions except such as might be found necessary, in the nature of things, by their actuaries; while societies with arbitrary reserve provisions in their charters might be obliged to make extra assessments to maintain those reserves, even though, in fact, amply solvent taking into account the real circumstances of the case; and, likewise, insolvent societies might continue provided only that the reserve provisions of their charters were complied with.

Thus by 1919 we find although friendly societies licensed by the Dominion were technically operating under the provisions of the Insurance Act originally designed for commercial assessment life companies, yet, in some cases by reason of the acts of incorporation and in other cases by reason of the manner in which the societies had voluntarily undertaken to conduct their business, there was, in fact, little similarity between businesses being done and that for which the special provisions of the Act were originally designed. In 1916 a Privy Council decision was handed down to the effect that the British North American Act empowers the Parliament of Canada to require a foreign company to obtain federal authority for the transaction of business in Canada. A number of United States societies had previously transacted business in Canada under provincial authority. Very few of them could comply with the requirements of the Federal Law applicable to old line companies; and there was no other general statute under which they could be licensed. The majority of them were insolvent even on applying the most lenient tests which could be applied with any reasonable show of justification. As already stated, Canadian societies had attained solvency with one exception, and that one society was not far from solvency. In the circumstances, it would seem the view taken was that, as the Dominion Parliament had the necessary power, something should be done to protect the public against insolvent societies, and also to protect societies doing business on a sound basis against unfair competition from societies charging inadequate rates. The 1919 Amendment to the Insurance Act, 1917, was passed to meet the situation above described, both in respect of Canadian societies and of United States societies transacting business in Canada. It is the more particular purpose of

these Notes to examine this Amendment in the hope of facilitating the formation of an opinion as to whether legislation along the general lines thereof may be expected to reasonably well meet the needs and requirements, from an actuarial point of view, of the business in which friendly societies are engaged.

The outstanding features of this business and the conditions and limitations under which it is carried on may advantageously at this point receive a moment's attention. To begin with, friendly societies do not issue what are known as "closed contracts." Additional assessments may be made if found necessary, or a reduction of benefits can be effected in some jurisdictions. There is little uniformity in benefits, business methods, or machinery. Some societies give no withdrawal consideration; others make a substantial allowance. Societies differ widely, *inter se,* as to mortality, lapse, sickness, etc. Membership is often limited to a certain occupation or occupations, to persons of one race or religion, or of one sex. Some societies have gone through a series of disturbing readjustments and the end is not yet, but the effect on mortality, for example, is often most important. Other societies have yet to readjust. The quality of existing investments and the interest earnings differ materially. Sufficient has perhaps been said to at least suggest some doubt as to whether the needs of friendly societies can well be met by uniform and arbitrary reserve requirements which can take little or no account of the essential facts of each particular case.

With this by way of introduction we may examine the Amendment above referred to, and it will be well to do so in about the order in which the several actuarial provisions first become applicable to societies.

All societies holding licenses at the time the Amendment came into force, were deemed to be licensed under the provisions thereof. Apart from the filing of statements and documents, the most important requirement, precedent to the licensing of any other society, Canadian or foreign, is the filing of a report made by an actuary, appointed by the society in which is to be included the results of an actuarial valuation of each benefit fund, having regard to the prospective liabilities and contributions. Unless the actuary certifies in his report that the assets applicable to each fund, together with the contributions to be received, are sufficient to provide the promised benefits at maturity, a license cannot, in accordance with

the terms of Section 107, be issued. The report and valuation of the actuary, required by Section 107, is in respect of the whole business of the society, not in respect of the Canadian business only.

It is specially to be noted that no bases nor methods of valuation are prescribed, nor is there any suggestion that consideration should be given to any reserve requirements or methods of valuation imposed by the laws of the jurisdiction from which a society derives its powers. It would seem the actuary is expected, taking into account the actual circumstances of the particular society, and of each fund thereof, to determine whether in his best judgment, the assets in hand together with the regular contributions to be received will provide the benefits granted. The word "solvency" is not used in the Amendment, but for convenience the above may be considered to be the test of solvency required. If the actuary is of the opinion that the several funds of a society are solvent, and if the society complies with the requirements as to filing of documents, deposit, etc., a license may be issued.

While, as above stated, no bases or methods of valuation are prescribed, and although a society chooses its own actuary, Section 116 of the Act limits the choice of Actuary to Fellows of this Society, of the Institute of Actuaries, or of the Faculty of Actuaries, with a proviso that in certain circumstances some societies might avail themselves of other actuarial services. The object in prescribing the qualifications of actuaries would seem to have been to insure that the work would be done by competent hands. With this safeguard it was apparently considered proper to permit the actuary appointed by a society full freedom as to valuation bases and methods, thus making it possible that due consideration and weight might be given to the circumstances of each particular case.

Notwithstanding the freedom in valuation permitted by Section 107, it was known that several of the United States societies transacting business in Canada could not get a certificate of solvency from an actuary. Presumably it was felt some hardship might result were they summarily required to cease transacting new business in Canada. It was provided by Section 108 that any such society might be licensed upon it being established that, in respect of policies to be thereafter issued, reasonable provision would be made in the premiums charged for the benefits granted. Licenses so issued may be renewed from year to year but not after March 31, 1925, unless the provisions of Section 107, as to actuarial solvency,

are by that time complied with. Any such society was thus given a period of five years within which, by whatever means seem most appropriate and expedient, to attain, in respect of the whole business, such a condition that a certificate of solvency may be forthcoming. It is understood that so long a period was fixed upon so as to give sufficient time for any necessary investigations, for an educational campaign among members, and so that any readjustment determined upon could be effected at a regular convention rather than at a special.

Provision is also made in Section 109 for the licensing of insolvent Canadian provincial societies on the condition that in respect of business issued after the date of license there is maintained either, (1) an adequate reserve deposit with the Dominion Government, or, (2) a solvent separate fund represented by separate investments.

The above deals with valuations and actuarial reports precedent to obtaining a license. We may now consider the annual requirements after a license is issued.

Section 112 (2) opens as follows: "The said annual statement shall include in the liabilities a reserve for mortuary benefits in which all the factors entering into the calculation are based upon the National Fraternal Congress table of mortality and four per cent. interest or such higher reserve as the society is required by its Act of Incorporation to maintain." From this it might seem that statutory bases of valuation were prescribed, but the Section goes on to state in terms identical with Section 107 that the annual statement shall, in addition, contain a report and valuation by an actuary and a certificate as to the adequacy of the reserves shown by the said valuation, no basis or methods being prescribed. Section 112 (3) further provides in respect of each fund except the mortuary fund, that the reserves shown in the actuary's report, or, at the option of the society, higher reserves, shall be included in the liabilities of the fund in the annual statement; and in respect of the mortuary fund, if the actuary's reserve is lower than that required by the bases in the above quotation, then the said lower reserve may be included in the mortuary liabilities. On the other hand, if the actuary's report shows the mortuary fund, or any other fund, to be insolvent, Section 113 becomes operative; and the result of this section becoming operative is that solvency must be established as speedily as practicable or business must cease. It might perhaps

be held that where the actuary's reserve is higher than the reserve on the bases in the above quotation, and the fund still solvent, that the lower reserve would appear in the liabilities thus showing a larger surplus than was warranted. In these circumstances it is not unreasonable to suppose that the Department would insert the actuary's reserve in the statement before publication. The significance of the reserve requirements of the above quotation would then seem to come to this: An annual statement in which the reserve is inserted in accordance with the provisions of the above quotation is complete for filing purposes, but unless the actuary uses the same bases in his report the reserve so entered has, in effect, no real significance. The important thing is the reserve determined by the actuary on such bases as he finds to be appropriate.

In the case of a society having its head office out of Canada, what has been stated in respect of the valuation and the report of the actuary for annual statement purposes holds, separately, in respect of the annual statement of Canadian business and in respect of the annual statement of the whole society.

From the above it would seem that the responsibility for determining whether a society, or any fund of a society, may continue, or whether a readjustment is necessary, primarily rests with the actuary; and in testing the condition of a society he is free to use such bases and methods as he deems appropriate. Thus, nothing need be required of any society which is not necessary in the nature of things for the security of members and in fairness to prospective members.

It will be perceived the actuarial requirements of the 1919 Amendment differ fundamentally from the requirements affecting Canadian societies, generally, or any particular society, at any time prior to the passing of the Amendment. They also differ fundamentally from the requirements in some other jurisdictions applicable to friendly societies. No attempt is here made to estimate the relative merits and sufficiency of the principles on which the 1919 Amendment seems to be founded and the more rigid and arbitrary provisions embodied in some statutes. It is thought better to leave this to those who may be pleased to take part in the discussion.

Discussion of Preceding Paper.

(ORAL DISCUSSION.)

MR. M. M. DAWSON:

I speak for the reason that, acting for some of the American fraternal societies which have qualified under the Canadian Act, I have had occasion to compare the Canadian requirements with the American requirements in the same regard, and I do not wish to go into particulars but I wish to say that the Canadian requirements are superior in virtually every respect. I think this is partly due to the fact that the methods up there were decided upon long after we had introduced our methods, and they had the advantage of being able to consult ours. But in any event, they are markedly superior in requiring thorough explanation of the method of valuation which the actuary employs.

The American method is, fundamentally, to value on one side the sums assured, and on the other side the future premiums or assessments receivable taken at their regular rates and not taking into account the right to call for increased assessments or special assessments unless such special assessments have already been levied. It also permits the use of aggregate tabular reserves. Nothing is required which shows whether the mortality is more or less favorable than as per the table employed; or whether the rates of assessment are or are not as high as the net rates by the table and method employed in the valuation.

Both of these matters are well taken care of in the Canadian requirements.

The Canadian law, however, provides that only the certificates of a Fellow of the Institute of Actuaries of Great Britain, of the Faculty of Actuaries of Scotland, or the Actuarial Society of America will be accepted. This is not only a very much more severe rule than we apply in the United States, but also a very much more severe rule than in Great Britain. There is the Fraternal Actuarial Association in the United States, Fellows of which are quite as well trained in this form of valuation as Fellows of our Society. This is also true of Fellows of the American Institute of Actuaries.

The full information concerning methods and valuation schedules which the law requires should be sufficient to enable the department to check the actuary's work and I think that when amendment is made in the Canadian law, it should provide that certificates of Fellows of the Fraternal Actuarial Association or the American Institute of Actuaries should be accepted.

(AUTHOR'S REVIEW OF DISCUSSION.)

MR. A. D. WATSON:

The purpose of the paper was to set forth as clearly and concisely as possible what seem to be the essential features of, and the principles on which, the Canadian Friendly Society Law was founded. Avowedly no attempt was made to estimate the merits or sufficiency of the law, as it was thought this might be more appropriately left to those taking part in the discussion. The paper being thus entirely expository, I am perhaps hardly called upon to here defend the law. I shall, therefore, confine myself to the correction of what seems to be a misapprehension and to showing that there may possibly have been a reasonable foundation for the provisions of the law which Mr. Dawson criticizes.

He states that the Canadian requirements are superior to the American in virtually every particular, and suggests that this is partly due to the fact that the former having been enacted at a later period the legislators had the advantage of consulting the laws of the States. In respect to the actuarial requirements of the Canadian law, it would not be possible to determine what influence, if any, existing State laws may have had; but this much is certain: the principle of permitting a person trained in actuarial work to rely upon his knowledge, judgment, experience and skill in the performance of his duties of ascertaining the financial condition of a society or a company, unhampered by any arbitrary restriction as to the bases or method to be used in any valuation or investigation or as to the formulae to be employed in any circumstances, is rather older than the provisions in that regard in any friendly society statutes on this continent.

Mr. Dawson says that the requirements of the Canadian law as to the qualifications of actuaries are more severe than in Great Britain or in the United States and suggests that, as full information concerning the methods and valuation are furnished, the Department should be able to check the work of the actuary employed by the Society, and, inferentially, that it is not of so great importance that authorized actuaries should be undoubtedly competent.

Without wishing to be in any way understood to express an opinion as to the professional qualifications of members of the Societies referred to in the latter part of the last paragraph but one of Mr. Dawson's remarks, I would point out that: (1) the kind of business friendly societies are engaged in, both in Canada and in the United States, differs very widely from the business generally transacted by friendly societies in Great Britain; (2) the responsibilities placed upon the actuary under the Canadian law are of far more serious import than under the friendly society's laws in Great Britain or in the United States; the responsibility of saying

whether a society is to continue business, or whether a readjustment of rates or benefits must be made, in effect, primarily rests with the actuary employed by the society; (3) the valuations made by Public Valuers under the Friendly Society Acts, England, are very far from being satisfactory to the authorities, as may be ascertained from the Reports of recent years. (See Reports for the years ending December 31, 1912, 1913, 1914, 1916, and 1917. I have not been able to consult any later Reports.) A large proportion of the valuations of Societies—in some years more than one-third—are either returned for correction or rejected altogether. The following comment of the Chief Registrar, 1912 Report, page 19, may be of interest: "It is evident some of the valuers employed are quite incompetent to perform the duties entrusted to them with the result that the labour devolving both on the staff of this office and the officials of the Societies is largely and unnecessarily increased." Comments of the same tenor may be found in the Reports of other years.

In view of the above there can scarcely be any two opinions as to the necessity and wisdom of requiring valuations to be made by persons who are undoubtedly competent. No question has been raised as to the competency of the classes of persons authorized by the Canadian law, and, therefore, it may perhaps be presumed that they are competent; and there would seem to be an adequate number of them to satisfy the needs of all societies. The interest of the public and of societies would thus seem to have been adequately protected and provided for in the law, and in the circumstances it may not unreasonably have been thought that, this much accomplished, the duties and responsibilities of the legislators had been properly discharged.

In the closing paragraph of Mr. Dawson's remarks he seems to suggest that as the information furnished is ample to enable the Department to check the actuary's work, there is less need of stringency as to the qualifications of actuaries. Would it not be a great pity were any society permitted, under guise of statutory approval, to employ an actuary whose work might possibly require checking, especially in so far as it could be checked from the information furnished? The suggestion does not take into account the fact that both the Department and the society must, it would seem, look to the actuary for guidance as to what, if anything, should be done in the best interests of the society in the way of readjustment of rates or benefits. Although the actuary is employed by the society, perhaps the correct view under the law is to regard him as a sort of employee of the Department for the special purpose for which he is employed by the society. In any event it could hardly have been satisfactory to authorize any class of individuals to perform duties of so great importance as the duties of an actuary under the Canadian law seem to be, openly recognizing at the same time the necessity for checking any part of their work.

The Insurance Company's Service to Employers.

BY

W. RULON WILLIAMSON.

Mr. Morris's recent paper on Some New Problems Affecting Life Insurance so thoroughly covered modern wholesale developments in life insurance that only the very wide importance of this part of his subject warrants a further consideration so soon after his discussion.

The large employer, however, is especially interested today in his employees' insurance. He recognizes the incompleteness with which these employees have purchased insurance. He feels a certain responsibility as to the income of his employees in old age. He desires to secure the best possible basis for meeting these needs. In spite of the fact that insurance companies have been reticent in offering him plans other than Group insurance, Group insurance has been presented, and the manufacturer recognizes that life insurance is a business requiring for its best results the experience, existing machinery and detailed knowledge of the subject at the disposal of the established insurance companies. Some employers have tried to secure pension systems from insurance companies and frequently have met with disappointment, largely due to their advance ignorance of heavy pension costs and because certain sections of the pension plans are not easily underwritten. They have also consulted certain men whose experience with employers and whose knowledge of the general theory of insurance has seemed an excellent basis from which to start, but whose lack of detailed and possibly actuarial insurance knowledge has frequently left the employer dubious as to his insurance plans, which may also have some actual actuarial weakness.

As Mr. Morris has pointed out, the knowledge of Group insurance has become very widespread and large volumes have been written in the recent past. We are just at present confronted with a financial condition which has slowed down the further development of this branch of insurance, and employers are analyzing more carefully than heretofore all plans of this nature before actually establishing them.

Either the consulting actuary or the life insurance company is available for assistance to the employer at this juncture. The life insurance company's organization is especially equipped to handle the employer's insurance, pension and thrift plans, both practically and easily, through a careful selection of established forms of coverage. The following brief outline indicates the possibility for such service to an employer with hardly the suggestion of a new contract form. Throughout the discussion the employer is assumed to have an adequate number of employees for Group insurance and a staff large enough so that some general pension plan might be under consideration.

I. Group Life Insurance.

Although Group life insurance has been variously defined and although the legal definition of Group life insurance in several states is sufficiently clear, we are limiting the consideration of Group life insurance in this discussion to that coverage where the employer pays the entire cost and where insurance is strictly in accordance with an established formula.

One of the best known selling devices is the free sample. To present a new product a small portion is presented to each of a large group of possible customers. If one likes the taste of the food sample he buys more. The employer appeals directly to the insurance tastes of his employees by giving to them Group life insurance. The essential points of the insurance are stated to the employee in a certificate. The sample must be large enough to give a satisfactory idea of the product yet leave the desire for more unsated. Sometimes the correct sample would be $500 for each employee and sometimes it might be $1,000. It must be large enough to be worth the trouble of distribution and must have actual merit of its own.

It may be desirable to complete the suggested program one step at a time, in which event the fact that this insurance is but a sample need not be stated to the employee. In order to obtain the maximum results from the sampling process, however, the purpose of the original purchase must be clear to the employer at the outset.

The insurance education of the employee is too incomplete to warrant consulting him at this stage as to whether he desires insurance or not. He does not understand the technical points such

as cost and the type of insurance carrier, and a two-party agreement between the insurance company and the employer can place the insurance in force.

Group life insurance can be marketed at a lower figure than is charged for regular life insurance. The employer buys coverage for all employees or all employees within certain broad classes. The coverage is temporary, to terminate at the termination of employment. Replacements stabilize age distribution and cost. The employer can buy term insurance for temporary protection, save through formula coverage the cost of medical examination and individual inspection, and thus because of the nature of the purchase secure this temporary protection very cheaply. The discussion of such cost with the employee in a cursory manner may cause misapprehension as to the cost of regular life insurance and should be avoided.

The immediate happy results of Group life insurance are important. It has furnished families cash payments at the death of the wage earner, has eliminated the necessity for charity and increased the self respect of the recipients. A check from a life insurance company represents a business transaction and can be received in this spirit. It impresses the family and the entire staff of employees as well. Under the provisions of the customary disability clause the insurance money is available during sickness where permanent total disability terminates the earning power of the employee. While the amount of benefit is usually inadequate for all requirements it at least decreases the amount of family indebtedness otherwise entailed. A special conversion clause permits an employee who appreciates this insurance to replace its loss by regular life insurance when he terminates his employment. An occasional individual technically uninsurable secures a small amount of protection.

The importance of Group life insurance should be sufficiently clear that its merits need not be over-emphasized. The type of employer who buys Group life insurance intelligently, recognizing both its advantages and its limitations, is the type of employer to hold his employees. Obviously, Group life insurance alone will not prevent strikes nor keep turnover low, but the employer who buys it should have lower turnover, less probability of strikes and fewer labor difficulties than the employer who does not buy it.

II. Group Disability Insurance.

Co-ordinate with Group life insurance, the employer may buy Group disability insurance. When carried it is much more frequently called to the attention of the employee by claim payments than is Group life insurance. Loss of weekly income because of disability is both definite and frequent and the employer may determine what proportion of wages lost shall be provided through insurance during absence from work because of disability. No additional amounts should be accessible as individual insurance. The distinction between term insurance and level premium insurance which is so important in life insurance is practically not existent in disability insurance (save in the limited field of the non-cancelable contract). So the employer may share the payment of premium for his Group disability insurance with the employee, with no danger of causing misapprehensions as to cost. With the insurance company's assistance he must present its benefits to his employees so as to secure the insurance of at least 75 per cent. of those eligible. For an adequate scale of benefits, the cost will presumably be greater than for a nominal amount of life insurance, yet due to the blanket nature of the coverage would be less than for similar individual disability protection.

Where the coverage, however, is incomplete, the sickness of the uncovered employee requires special and embarrassing consideration. The employer who alone pays for his Compensation insurance, which grants indemnity for time lost because of accidents during employment, may also pay entirely the Group disability premium in order to avoid the hasty immediate educational campaign otherwise necessary, thus easily securing the maximum benefits from the disability contract with complete coverage. The employer who requires all employees to pay part of the cost may balance his gains in completeness of coverage and reduction in the cost to himself by loss of plant morale.

While this coverage may be granted by employee's benefit associations, the logical carrier is the insurance company. An insurance company handles, as a part of its business, the settlement of claims. It saves the employer or a committee of employees either the awkwardness of strictly just claim settlements or the unfairness of over-generous ones. It can state with precision the exact benefits granted. Assuming the same amount of claim payments whether

insurance is carried by an insurance company or by the employer's own organization, while it may cost the employer slightly more to reinsure, he would thus secure valuable professional service.

III. Pensions.

Theoretical pension considerations are largely debatable, but the simple treatment suggested by Mr. Morris is available for any employer paying pensions as they come due and is worthy the consideration of an employer still lacking a pension plan. Employers have been paying pensions to certain employees upon retirement much longer than they have been using Group life insurance. The development of Group life insurance has taken place, however, co-ordinate with the recognition that it was an insurance company business. Many employers now granting pensions are frankly troubled by the constant increase in cost and are asking aid from the insurance companies. The usual method of handling pensions has required certain safeguards so that the employer may not guarantee to the pensioner the receipt of the annuity during his life. A plan safeguarding the interests of both employer and pensioners is preferable. Pensions are sometimes called "deferred pay," but it is difficult for an insurance company to admit the "deferred pay" principles and handle pensions like deferred annuities—for withdrawal and wage rates can be determined only with difficulty. If we consider the pension only as a gratuity payable by the employer to such employees as he may elect to pension, the simplicity of mechanism is surprising. Presumably the employer will elect to pension employees according to some underlying plan in order to secure the most general satisfaction among those pensioned or apparently eligible for pensions. The pension being something *given* by the employer is not *earned* in uniform increments year by year, but is given entirely after what may be termed a lifetime of service to a given employer, a record sufficiently noteworthy and distinctive to merit exceptional recognition. The pension of course is not given to the employee at the height of his usefulness, when the termination of his employment would harass rather than help the employer, but only when the age of the employee is so advanced that continued work on his part gives diminishing results and when the elimination of the worker, who has served well, is advisable but being advisable seems to call for some gratuity still. As each employee is pensioned the

employer buys a single premium life annuity and can safely promise the receipt of the pension during life.

The amount of the pension should be large enough to be recognized as a definite benefit but not so large that its size will menace the permanency of the program. The consideration of the next section will largely determine the exact basis. The employer recognizes that old age comes to different people at different ages and will leave somewhat open the exact age for retirement.

Practically, the employer cannot promise these pensions to the younger employees to hold them in his employ, for he cannot foretell the future development of the corporation, its subsequent management or policies, the gain or loss in the use of his particular product, economic disturbances affecting the value of the dollar or possibly the very life of the plant, but he can with reasonable accuracy forecast for a few years in the very near future the cost of granting life annuities to that limited number of employees who because of old age and long service may be eligible to qualify during the period. An employer, for example, determines for his immediate guidance a crude program for pensioning each employee who shall have completed at least 20 years of service at the age of 65, provided the employee desires such retirement and it seems wise in each case specifically, with compulsory retirement at the age of 70. He may have out of 1,000 employees but 30 who can possibly become eligible for pensions because of old age within the next 10 years. He cannot guess at the withdrawal rate at the younger ages, but he knows it is very unimportant among this group. Ignoring deaths and withdrawals there will be on the average 3 pensioners a year who can elect pensions during the next 10 years. The cost of each life annuity of, say $500 yearly, granted at age 65, is approximately $5,000, so that the maximum average annual strain for a 10-year period is $15,000. This strain is of a different sort than is usually indicated by yearly pension outlays. It discounts the complete future cost of all annuity payments to each individual and through the insurance company from whom the annuity is purchased guarantees the continued payment year by year throughout life. The actual cost to the employer will vary year by year due to the pensioning of different numbers in successive years, but with the aid of the insurance company a satisfactory general idea of cost, considering also mortality and interest, can be secured.

The employer can even, with guidance, place in a trust company reserves to meet the higher strain in succeeding years.

By the use of single premium life annuities, the present management can be assured that those employees who retire will receive payments with certainty during their entire lifetimes and that no future management can reverse the pension policy so as to affect employees already pensioned. An employer might buy deferred life annuities but this alternative is better applicable under a contributory plan, and we are discussing in this section only purchases by the employer alone. When the employer reserves for pensions over a period of years, the additional cost for deferred annuities on all the staff would require an enormous initial outlay. Should the plan eliminate pensioners shortly eligible and provide pensions only in the future through accumulated annual payments, he will be buying pensions on his employees of whom relatively few will reach pension age, and his pension provision, instead of being localized to cover actual pensioners, will be spread out over non-pensioners and pensioners alike. A continuance of present policy cannot be counted upon and unusual foresight and wisdom is required for such a plan. The simpler plan recognizes what pensions will cost in the immediate future and by determining the present value of each pension, give the employer the opportunity to review both benefits and costs. He might better drop the plan before he starts than to start and then abandon one.

These pensions are more or less "samples" too, like the Group life insurance. They call to the attention of the employee the necessity for personal provision for old age by the rather hackneyed means of personal thrift. If pensions hold employees, they may hold the least desirable among the older men who fear to leave, and influence but little the younger men to whom immediate advancement, training and income are of more moment than old age benefits. It is, again, the *type* of employer who goes to the expense of pensions who has the rest of the program to retain his employees.

As a subordinate part of the general pension scheme, but one very important in its benefits, the employer can provide for the group of employees not yet at pension age, but who have completed 5 or 10 years of service, a special disability pension payable during permanent total disability. The insurance company can provide these pensions by a blanket One Year Term Permanent Total Disability contract, provided the rest of the program is carried. Thus, in lieu

of using up the Group life insurance coverage in those cases totally and permanently disabled such life insurance benefits may be conserved until death and a disability income furnished by this special disability contract. The recent development of individual noncancelable disability policies and group temporary disability coverage indicate the possible method of writing this insurance.

IV. The Employee's Personal Purchases.

The earlier portions of this program are preliminary to its larger and more valuable service of educating the employee through the example of insurance actually in force to buy more. When one employee sees that the other man's widow gets $1,000 upon her husband's death, he has had a practical lesson in life insurance. He consults again his own insurance certificate, to assure himself that he too has that $1,000 insurance, and is impressed by the thought that the $1,000 of life insurance given him by his employer will not go very far toward furnishing his wife and his children with a reasonable substitute for his own earning power. His education in life insurance has begun.

That employee is ready to discuss with the representative of a life insurance company this question of his insurance responsibility. Obviously he may be served by the representatives of an industrial insurance company or of a fraternal organization, but the varied contracts of regular or old line insurance by themselves furnish so complete a schedule that only such insurance will be considered here.

No employer desires to destroy initiative, or the personal responsibility of his employees, and there has been pertinent objection to providing Group life insurance to employees without cost to the employees, and alternative consideration of the use of Group life insurance in an optional way whereby *at least* 75 per cent. of the force may buy this protection, sharing the cost with the employer. The objection is good,—the solution not the best. The contributory group case does create large insurances—but it also opens up the baffling questions of how to keep constant the average of a shifting set of varied, individual costs. Neither the employer nor the employee desires his share of the cost to increase, and yet the very nature of the plan makes such increase probable, and the increase compared with only part of the premium, the share of employer or employee, seems larger than when compared with the

whole cost. Group costs are predicated upon the cost of selling an idea to an employer,—it costs more to add the expense of individual solicitation. The protection is term, temporary coverage.

The history of fraternal orders and assessment companies operating on an average cost basis was uniformly satisfactory in the early years of their existence while the average age was low. Gradually, however, since the insurance was after all individual insurance, the age of the group as a whole advanced and steadily the organizations were confronted with the necessity for increasing rates, and increasing rates which the individuals had supposed were permanent. Old men whose only insurance was of this variety and who had even used the insurance as a basis for loans or to secure other definite benefits were left with no protection whatever to back up arrangements which they had made in all good faith. The fact that they had secured their money's worth was little solace to them.

It seems possible that similar misapprehension would arise in the minds of the individuals purchasing contributory Group insurance. There is no guarantee that the master plan will be continued permanently and the ultimate provision for employees may be extremely awkward for the insurance company. Education will then be very difficult. Costs, based on averages where coverage is not strictly by formula, change, and the employer is likely to become disgruntled by changes in rates which he had assumed would be stable.

The employer will, we believe, achieve better results if he uses the amount which he would otherwise pay towards the contributory group plan to buy possibly a reduced, but at least a specific amount of Group protection directly, allowing his employees to buy regular life insurance to supplement it.

Level premium protection has seemed on the whole the happiest form for the man who buys such insurance. Its cost includes the expense of personal presentation to each insured. Numerous forms meet the varied requirements of any individual.

It is not sufficient to tell the employee or the employer that it is to the advantage of the employee to buy regular life insurance and let it go at that. Regular life insurance sold with annual premiums, payable in semi-annual or quarterly installments only, does not fit the employee's disbursement schedule. His income is spread evenly over the year. Industrial insurance with which he is familiar has premiums spread out in the same manner. Regu-

lar life insurance can be adjusted to a monthly payment basis without adding materially to the amount of the premium payment, where the employer will co-operate to reduce collection expense. It costs more for the insurance company to accept premiums monthly, but it need not cost very much more to get them monthly than to get them quarterly if the employer will handle this premium payment by monthly payroll deduction. The insurance benefits are not changed, but the method of paying the premium is adapted to the man who is buying the insurance.

There must, however, be a certain expense saving to the insurance company to counterbalance the lower average sized policy which will be written. Let us assume that the average policy in the Company's regular business is $4,000 and the average policy thus written on employees is only $2,000 and a definite per policy expense known to hold for writing the business. Obviously, the acquisition cost per thousand will be higher on the smaller contracts and loadings based on the higher coverage may be found inadequate to handle the expense incident to writing the smaller contracts. Where, however, contracts are sold in large numbers for small individual amounts, selection against the company becomes much less serious. The employer's approval can replace inspection reports. On the young employees who will constitute the larger part of the group to be insured, the usual elaborate examination is essentially unnecessary for small amounts of coverage, and a briefer and less expensive examination may be substituted, yet result, it can be assumed, in no extra mortality strain. If the employer remits monthly premiums collected monthly by payroll deduction the company's collection costs are kept as low as on larger contracts. Otherwise, the same expense is present as in other business. The agent can be compensated for his service in selling the employee the insurance he should have; the policies are the usual policies; the price is the usual price. So far as the employee is concerned he is buying insurance as an individual, and he has the same courtesy shown him by the insurance representative that the small depositor in the bank secures from the bank employees.

The variety of insurance needs among any group of employees requires intelligent recognition. In the employer's personnel department there might well be a special insurance section to advise with the agent as to the correct insurance requirements of the employees solicited. Among the forms of insurance which may be sold the

employees there are certain illustrative types which should be mentioned and one non-insurance service which is nevertheless an essential part of a thrift provision for the employee.

A. Whole Life Insurance. The policies written in the Ordinary departments of life insurance companies are generally divided into three classes:

(*a*) Whole Life Insurance,
(*b*) Endowment Insurance,
(*c*) Term Insurance.

Whole Life insurance implies that the insurance will be continued during the entire lifetime of the individual; Endowment, that insurance is for a limited term of years and will terminate when a cash payment approximately equal to the insurance is made to the individual at the end of this period; Term insurance, that insurance is for a limited period of years only.

Most individuals consider the Whole Life contract as the backbone of their insurance program—insurance which will ultimately result in a death claim. The Ordinary Life variety requires premium payments during the entire lifetime of the insured and is the cheapest form of Whole Life protection. There are various devices for making premium payment at advanced ages unnecessary, the most popular being the 20-Payment Life contract. This form is not well suited to the young, low-salaried employee. The young man who buys 20-Payment Life insurance because he wants insurance for his whole life procures less protection than is possible for the money he puts into the plan, and the insurance premiums cease just at the time when he is normally best able to pay them. Probably the most satisfactory form for the employee would be insurance with premiums payable to age 65, the age at which most employees think they will retire. The employee with a level income can secure maximum protection under the ordinary life plan, and should he terminate his earning capacity at age 65, with children grown-up and with but a short after lifetime for his wife, he may wisely take a reduced amount of paid-up life insurance and avoid further premium payments. $5,000 of Ordinary Life insurance including a disability provision, paying $50 per month during permanent total disability and waiving subsequent premium payment on the life insurance may be purchased by the young man of 25 for about $7.00 a month, by the man of 35 for about $10 a

month, while a single thousand could be purchased for approximately $1.50 at age 25 and $2.00 at age 35.

B. Term Insurance. This type of life insurance has a very definite, if strictly limited, place in the schedule of the employee's possible insurance coverages. It is especially adapted to the capable young workman whose advancement is practically certain in that it gives him the opportunity to purchase more protection for a given expenditure than he could get on Ordinary Life rates, when he needs protection most, but with the understanding that this protection must be subsequently converted to a level premium form to avoid constant increases in cost in future years. The exceptional young man, for example, who is almost assured large increase in income within a 5-year period might secure $10,000 at age 25 for $9.00 a month, this cost becoming $17.00 a month at age 30 should he at that age convert to Ordinary Life insurance. A type of contract now in vogue makes this conversion automatic at the end of a given period.

Other instances where Term insurance is desirable are:

1. The employee with Ordinary Life coverage for the benefit of his wife needs Term insurance for his small children until they shall become self-supporting. This need is recognized in Compensation insurance and in life insurance is best met by Term insurance.
2. Term insurance should be secured for the amount of mortgage outstanding on the employee's home.
3. Term insurance could be used to cover a temporary indebtedness of any sort.

In the hands of an experienced salesman Term insurance can give service far beyond that now furnished and can fill insurance requirements which, though recognized, are seldom filled.

C. Provision for Old Age—Deferred Life Annuity. Old age protection demands of the individual strenuous self-sacrifice and wise accumulation of funds through investment. A consistent long time program such as this is with difficulty carried out by most individuals. Life insurance companies furnish a simple method to provide for one's old age. The monthly cost to the employee to provide such an income during old age is inversely proportional to

the length of the interval between his present age and his age at retirement. The man at 45 must set aside monthly nearly 3½ times as much as the man at 25, simply to achieve the same results at 65, for the younger man has not only a longer period during which to make his payments but is benefited by the extra interest accumulations on the early payments. Where the young man has life insurance as well, the fact that no payments are made on the Deferred Life Annuity contract in event of death prior to age 65 will have no particular importance to him because he is purchasing merely an income at age 65 at the lowest possible cost, and yet it is a natural desire on the part of many individuals that forfeiture shall be eliminated and a Cash Refund Annuity can be purchased which shall provide that, save in the very early years, there shall in no case be returned to him or his estate an amount less than he has paid for the contract. Moreover, permanent total disability income can very simply be included with a Deferred Life Annuity contract, so that the amount of income for which provision is made at age 65 may become payable immediately upon premature old age evidenced by permanent total disability. To provide an income of $50 a month at 65 the young man of 25 might spend but $4 a month. Extension to the cash refund feature would bring the monthly cost to about $5, while the disability privilege could be added for but $0.50 a month. It is thus possible for the young man with good earning power to begin his provision for old age in such a manner that the actual monthly outlay is well within his means, and he may even start such provision before marriage makes the need for insurance protection particularly keen. He may know that the employer has a pension fund established whose benefits will assist him,—but that primarily he is on his own resources.

D. Long-Term Endowments. Deferred Life Annuities combined with Long-Term insurance are frequently more appealing than the two types of coverage purchased separately. There are numerous types of coverage providing $5,000 life insurance with various amounts of old age income, approximately $500 yearly, which can be purchased by the young man aged 25 for only about $10 a month. One extreme type of this coverage grants an income at age 65 of $1,000 per annum, this income guaranteed for at least 10 years, gives life insurance from age 25 to age 65 in the amount of $5,000, provides for special disability annuity of $50 a month in event of permanent total disability, at a cost of but $14 a month. The

variety of these contracts is such that practically any old age income can be matched up with any insurance protection in the meantime. Many of these contracts allow option of a cash payment at age 65 in lieu of the life annuity, but acceptance of such payment should be made with great care by the employee in order that the result of years of accumulation shall not be lost through speculative forms of investment.

E. Temporary Savings. An employee may provide adequately for his old age, for benefits at death to his family, and yet be inadequately prepared for such financial contingencies as occur steadily. Savings for unforeseen contingencies in the near future, for certain specific expenses or investments should be a part of any employee's well-rounded budget. These savings can best be accumulated in a savings bank rather than through insurance since insurance must be mortgaged when a loan is made against it or must be entirely surrendered to get at the savings for actual use without a mortgage. A Short-Term Endowment has been suggested by insurance companies as an unequaled method for accumulating savings. It has been satisfactory in a limited number of cases because it has actually made the individual carry out his savings intentions. The individual who buys insurance regards premium notices as bills and where accustomed to pay his bills, meets his premium payments. The savings bank can follow the example thus established and arrange with the employer for a systematic method of deposits for employees. The employer who has in operation the above life insurance plan can extend it to cover monthly deductions for bank deposits and can thus complete the insurance and savings program of the employee.

The co-operation between the employer and the insurance agents responsible for the success of this life insurance and savings coverage must be very close in order that in each instance the proportion of savings and insurance premiums may not be entirely beyond the means of the particular employee. Moreover, it must be recognized that where, as is the case to-day, wages are likely to decrease instead of increase, the installation of a plan of this sort must be very carefully conducted. As wages really do fall, their purchasing power will be greater and the fewer dollars that come to the employee the more valuable they become. It is at such a time

that the importance of insurance and savings is especially clear to the employee, and when deflation has been accomplished to a certain extent the right sort of employer and the right sort of resident agent should be able to accomplish very definite results with this program. In fact, it is probably the time now for the employer with the financial stability to do it, to install Group Life insurance, Group Disability insurance and such Pension provision as he plans to make in order to be equipped to put in operation the balance of the program at the proper time.

The Cost of the Program.

The actual cost to the employer and employee for any part of the entire program will vary widely. The cost of Group Life insurance is roughly 1 per cent. of the amount of insurance, varying with the age, occupation and insurance distribution involved in each case. The cost of Group Disability insurance for one plan of coverage on risks with no special industrial disease hazard, with sanitary, healthful conditions and good class of operatives is about a single week's indemnity, but the cost may vary according to maximum time granted, occupation, and other factors. Pension costs for a young concern are light, for an old one heavy. We have shown in an example above a cost of $15 per capita—a very low one. What costs should be, within reasonable limits, can be estimated by an insurance actuary in any specific case. Even under favorable conditions they usually seem extreme to the employer.

The cost to any employee should be as large as the employee can meet permanently, since the protection and thrift part of his budget is much more important than is usually indicated by the proportion spent on it. Here the effort of the insurance salesman should be directed to assist the employee to buy the best type of insurance coverage for him individually. If we assume an employee aged 25 drawing $120 a month, who elects to spend $15 a month, he might buy:

(*a*) $3,000 Ordinary Life insurance costing monthly about	$ 4.50
(*b*) $50 a month Annual Premium Deferred Life Annuity, first payment at 65, costing monthly about	4.00
(*c*) Savings to reach $1,000 in 10 years at 4 per cent. interest	6.75
Monthly Outlay approximates	$15.25

His employer could furnish him:

(*a*) $500 or $1,000 Group Life insurance, or an amount determined by length of completed service.

(*b*) $18 a week indemnity for disability from sickness and foreign-to-occupation accidents, 26 weeks limit on both, 7 days' waiting period on both.

(*c*) Coverage under a general pension plan granting $30 a month at age 65, as well as

(*d*) Permanent total disability protection after he completes 5 years of service, in the amount of $30 a month during permanent total disability.

The employer will also have in force compensation insurance covering death, dismemberment and disability from injuries arising out of the hazards of employment.

Just what the employer grants will be decided by how much he can spend and just how interested he is in this very extensive program. Although Group Life insurance and Group Disability insurance presumably involve a fairly definite expenditure the cost for Pensions may vary so widely between employers that it seems wiser not to attempt an estimate of what his outlay for this portion will be, while the cost for blanket permanent total disability coverage will be a small fraction of the cost for pensions at old age.

At the basis of the insurance plan as outlined lies the consideration that in the main what the employee spends represents a definite purchase as distinct from similar definite purchases by the employer. There is no juggling of comparative costs to the employer and the employee for a common benefit, but a definite line of demarkation between what the employer does and what the employee does. The installation of the various parts of the program requires the services of an insurance representative who understands insurance.

The particular method suggested in this paper avoids the tacit assumption underlying much social insurance discussion, that the working man cannot afford regular insurance and must, therefore, have some special assistance through state aid or similar subsidy and usually a waiving of actuarial limitations to place coverage in force. Obviously, certain elements make up the cost of insurance and I have seen no satisfactory method of giving standard insurance protection at other than standard insurance rates.

A recognition of the necessity of following fundamental actuarial concepts is important if the education of employers and employees is to be satisfactorily achieved.

Discussion of Preceding Paper.

(WRITTEN DISCUSSION.)

MR. MERVYN DAVIS:

Mr. Morris in his paper on "Some New Problems Affecting Life Insurance" which was read before the last meeting of the Society, indicated briefly how an employer who has purchased Group Life Insurance for his employees might further co-operate with them in obtaining additional insurance on the individual plan. We are now indebted to Mr. Williamson for a detailed description of the ways in which the services of the insurance carrier may be used to assist the employer in providing, not merely additional life insurance, but a comprehensive program including insurance against temporary and permanent disability and old age pensions.

In the conclusion of the paper Mr. Williamson describes what might be termed the ideal program which is to be finally installed and discusses the cost to the employee of carrying out his part of the program. In this discussion Mr. Williamson assumes that the employer is to furnish Group Life Insurance, Group Disability coverage, permanent disability protection and a part of the old age pension, while the employee is to supplement these benefits by additional life insurance and his share of the deferred annuity or pension, the contributions of which are to be met by monthly deposits.

The difficulty arising in connection with the collection of premiums might be solved by the inclusion in the standard contract of a provision to the effect that where a number of such contracts are issued to employees of one employer and where the employer undertakes to make payment of the premiums required, such payment might be made monthly. This would enable the employer to collect the premiums by means of payroll deduction and would eliminate the necessity of offering monthly premium payments to policyholders in general or of continuing employees' policies on this basis after they had left the service of the employer.

In the matter of pensions, Mr. Williamson points out the defects usually found in the average pension fund and suggests that the employer's obligations in the matter of pensions be met by the purchase of single premium annuities for those employees who reach the pension age, the pension thus furnished being supplemented by deferred annuities purchased by the employees. A more flexible plan could be provided by the issue of contracts calling for the payment of a definite premium, the accumulations of which would be applied to the purchase of an immediate life annuity when the pension age is reached or at any time within a specified range of ages. For a small extra premium the contract could

provide that in the event of total permanent disability the payment of premiums would be waived and a disability income be paid to a certain age, say 60, or 65, when the regular pension would begin. A stipulation that only employees in service five years or more would be eligible to subscribe to such a contract, would limit its issue to those employees who would be likely to remain permanently with the employer while the problem of withdrawal benefits would be disposed of by allowing the accumulations of the employee's premiums to him as a cash surrender value on his leaving the service. In the same way the same accumulations or the accumulations of both the employee's and the employer's contributions could be allowed as a death benefit.

The program outlined is based on the supposition that the premiums for the Group Life and Group Disability insurance are to be paid entirely by the employer and Mr. Williamson gives some excellent reasons why the contract should be written on this basis. Unfortunately, however, we are confronted by the fact that there seems to be a growing tendency at the present time to write Group Insurance on the contributory plan. In many cases this is due to a feeling on the part of employers that the average employee will not appreciate the insurance unless he has to pay a part of the cost; possibly in many of these cases the objections of the employer may be met and his future co-operation secured, if the agent is able to persuade him that the placing of the Group contract represents only the first step in a comprehensive program which is to be further developed by the offering of individual policies to the employees. Again many employers at the present time seem to feel that owing to the necessity of reducing expenses they are compelled to either reduce the amount of their Group Insurance coverage or to place it on a contributory basis. The first class of cases would seem to offer excellent opportunities for writing employees for individual insurance but it is improbable that the employee who is called upon to share the cost of his Group Insurance will prove a likely prospect for additional insurance.

The plan presented is based on the fundamental idea that the employee has been educated to appreciate the value of insurance through his observation of the results achieved by the Group Insurance carried by the employer. The installation, therefore, of so complete a program as that described by Mr. Williamson would have to be made in progressive steps keeping pace with the progression in the education of the employees. To do this would require intensive work on the part of an agent or staff of agents of unusual calibre, men thoroughly familiar with the different types of contract involved, and it is doubtful whether for such men, the compensation earned would adequately repay them for the time and labor spent.

MR. C. D. RUTHERFORD:

The author in this paper has dealt very fully with what constitutes practically a new branch of Life insurance.

It has long been recognized that Industrial Life insurance constitutes a separate type of business and one with which an ordinary company cannot safely meddle in a half-hearted manner; yet the fundamental difference between the Industrial and Ordinary Life insurance business is not in the scientific basis but in the mode of collection of premiums. In like manner the operation of an insurance service to employees through the medium of the employer constitutes a separate and distinct branch of the business. Indeed a Life Company has been incorporated in Canada for the sole purpose of providing such service, in connection with a large mail order house. The same general warning applies to this type of insurance as applies to Industrial insurance—it is not safe for an ordinary insurance company to meddle with it in a half-hearted way.

The author has divided his paper into four main sections. The subject of the first of these—Group Insurance—is more or less familiar to us all, although its peculiar difficulties are naturally best appreciated by those directly engaged in the business. I must protest, however, against the repetition in this section of a statement which is found in almost all Group insurance literature, namely, that Group insurance costs less than regular Life insurance. I have very little hesitation in saying that so far from this being the case, there are many of the best managed Life Insurance Companies which are giving Ordinary insurance at a lower net cost than Group. In considering the saving of medical fees and the reduction of commissions, one is too often apt to overlook the heavy increased administrative expense in connection with a large number of certificates for small amounts.

In the second section which deals with Group Disability insurance, the problems are almost wholly practical, there being little in the way of difficulties of a theoretical nature.

In the third section the author deals with a very important present-day problem. There is little doubt that there is a gradually increasing demand from employers for pension schemes. In this connection he has elaborated a suggestion thrown out by Mr. Morris. This is briefly that the average number of employees likely to be pensioned in the next four or five years is a fair indication of the number who will emerge annually for an indefinite period. It is worth some consideration whether this is not the same type of argument which led to the formation of Level Assessment Fraternal Orders, and whether it is not likely to have ultimately the same disastrous results. The author's words are significant, "He (the employer) might better drop the plan before he starts than to start and then abandon one." It would appear

to me that the ultimate consequences of such an arrangement would be of the same nature as those arising from setting up a pension scheme unsupported by any fund. The only difference would be that whereas the impossibility of continuing under a pension scheme does not appear till about 50 or 60 years after the firm has reached a moderate degree of development, the difficulties of this scheme will appear in about 30 or 40 years. The author has suggested that relatively few of the employees will reach the pension age. On consulting the Service Tables for several different pension funds I find that the proportion of employees age 30, who are still in the service at the age of 60 varies from 45 per cent. to 60 per cent. Since those who reach the age of 60 are only likely to leave the service on account of death or retirement, it can be seen that the ultimate cost of pensioning is likely to be a serious matter. Personally I am of the opinion that the difficulties in the way of handling a regular pension scheme through an insurance company have been greatly exaggerated. The difficulties are three in number, that arising from the rate of withdrawal, that arising from an optional pension age, and that arising from changes in salaries. Of these, the first two can be dealt with satisfactorily by approximate methods, while the third presents no practical difficulties whatsoever if the scheme is covered under a single blanket contract and not by individual policies.

I am inclined to consider the point one of the most important of present-day problems. It is a matter for consideration whether it is not the gradual accumulation of old employees in a firm owing to the lack of definite provision for retirement that prevents so many corporations from reaching an age much beyond the span of a single life.

Passing on to the fourth section of the paper, I would heartily endorse the author's statement of the difficulties in regard to contributory Group policies. There is a distinct tendency in such cases for an employee to try to retain his insurance under the Group policy after he is pensioned or retired from service at a high age. This is more particularly the case if the portion paid by the employees is calculated at an average rate. The main part of this section is devoted to setting forth the arguments in favor of monthly payment business where the payments are made by payroll deduction. It must be remembered in this connection that the real cost in connection with frequent premium payments under Ordinary insurance is not so much the actual cost of collection as the persuading of the assured to continue his policy in force during the first few years. The danger under the payroll deduction scheme is that whenever the assured is pressed for money he is liable to request the cancellation of the deductions and the policy is lapsed or surrendered before the agent has an opportunity to place his argument before the assured. Throughout this section the author has laid considerable stress on the question of saving in

cost. It must not, however, be overlooked that the cost of selling such an extensive program to the employer will in itself be considerable, and the employer will usually require that assistance also be provided for selling the scheme to his staff. This latter process must also be repeated from time to time at intervals probably of two or three years, and throughout there will be an administrative cost in excess of that under a similar volume of Ordinary business. It is very questionable whether there will be any saving in cost to the Company and consequently to the assured.

I am conscious that these remarks have done little more than refer to the more obvious difficulties in the suggested plan. On the other hand the author's presentation is so clear as to make any other course unnecessary.

(ORAL DISCUSSION.)

MR. C. D. RUTHERFORD:

In addition to what I have written, I might remark that we can compare in this connection the experience in the earlier years of the Massachusetts Savings Bank insurance scheme, where large groups of employees were sold through the employer at one time, and the cancellations proved to be very heavy at times. In regard also to the question of the pension business and the rate of withdrawal, a practice has grown up in Great Britain, which has not yet reached this side, of taking it for granted that when a pension is promised to an employee beforehand, if he leaves the service of the employer he is entitled to some method of getting credit for the service he has put in. In practice such an arrangement can only be made through an insurance company. It has been handled in some railway pension funds in Great Britain by allowing an ex-member to continue his contribution to the fund on paying the employer's portion as well but that is not a very satisfactory method; the solvency of the fund is not assured. In general, the principle of transferable service has been adopted and approved by government commissions in the matter.

MR. J. F. LITTLE:

There is just one thing I want to speak about in this paper. The author is recommending that a pension scheme be worked, if I understand him rightly, after this fashion: that when a man reaches the pension age and is to be pensioned the entire cost of the pension be then taken out of whatever funds are available, the idea being, I believe, that the employer should normally stand the whole cost. The author admits that that would give irregular costs in various years, and suggests that something might be done by keeping an account in a bank or trust company to prepare for the years where unusually heavy strain might occur. This is not

a satisfactory arrangement. Remember that no matter how one may disguise the fact, the pension is deferred pay. That is indicated in the English experience, which covers a longer period than our own, an investigation recently made having shown in the case of the Civil Service that whatever benefits were granted by way of pension in the long run effected a reduction in the pay of the employees. The provision for pension is merely a supplementary way of paying the employee. It follows that the business should carry its own current costs today and not postpone any part thereof to future years. The future years may not be in a position to carry the accumulated cost with the heavy interest burden that the accumulation includes.

The author states that deferred annuities can be bought, but, he says: "When the employer reserves for pensions over a period of years, the additional cost for deferred annuities on all the staff would require an enormous initial outlay." Whether that be true or not, it is the cheapest way of providing for the pensions. If the enormous initial outlay for these pensions is too serious for an employer to carry, then the ultimate cost to him of waiting till later on to provide them is going to be a great deal more burdensome.

As a matter of fact, a pension scheme is largely a matter of psychology. If the employee is told that the employer will, if he pleases, pension employees after a certain plan, if he hasn't changed his mind before that plan comes into effect, it then becomes very much a matter of the confidence of the employee in the employer. If he sees the employer making no provision whatever for pensions in the meantime, he begins to wonder whether, if his pension age is 20, 30 or 35 years in the future, there will really be anything for him when he gets there. Now, in certain cases the employer's good faith is probably enough, but there are many cases where the employee in a commercial business knows that bad years may come and the concern may run down hill and may not be able to pay the pensions, may, indeed, become insolvent, and the ordinary employee is very much better pleased if he sees a separate fund being accumulated for his benefit.

To my mind, the ideal fund is one where the employee himself pays a contribution deducted from his salary or wages, and where the employer undertakes, with whatsoever limitations are necessary, to contribute something further in the meantime. The resulting fund is set aside and invested outside the business so that if the business should become insolvent the fund will still be there for the benefit of the employees. In the case of an employee leaving he should be allowed at least his own contributions with something for interest. Personally I believe in the recommendation of an English actuary in a recent report on some pension fund, namely, that the employer should allow his own contributions to be taken as well as the employee's when the employee left. While that

might look like putting a premium on leaving the service, in actual practice we find that the employee who is unusually well treated by his employer appreciates that fact; at least if he is an employee that is worth keeping he will appreciate that fact, and instead of it tending to cause employees to leave they are apt to reason that an employer who is treating them so decently is the one they should stick to in order to enjoy still more of his consideration.

I had an illustration of this view recently. Regular twenty-payment life policies were issued to a group of employees, and the employee paid only a fraction of the premium; the major part being paid by the employer. I was speaking with the welfare manager of that concern recently and asked him how the plan was working out. "Why," he said, "it is splendid, and the thing they all like is that there are no strings to it; there is nothing to prevent the man if he wishes from borrowing on the policy or surrendering; it is absolutely his own property. There is no restriction on him, although he understands we would like him to keep the policy in force while he remains with us, but we put no restrictions on him." It was decided in this case that nothing would be done to interfere with the absolute liberty of the employees in handling the policies. He says they are all delighted with it, and that is the particular feature that wins them.

Remember, as I said, that it is a matter of psychology; the apparent liberality of the employer in allowing even his own accumulated contribution to be paid to the employee leaving the service will probably serve the employer better than allowing the employee's only.

It is very common nowadays to propose that we should have a system under which the employee's contribution shall merely be accumulated and whatever pension the accumulation will buy will then be purchased. I think most employees would rather have some sort of a definite plan, such as one and a half per cent. of salary for each year of service, even though there might always remain the proviso that if the fund is not sufficient a reduced pension shall be paid. Such funds have been carried on for many years, more on the other side of the Atlantic than here, and they have been very successful where guided by competent actuarial advice, and they form, to my mind, the best solution of the pension fund problem that is available today.

MR. J. D. CRAIG:

Group insurance has brought the question of pensions in this country to the forefront so that companies interested in this form of insurance are continually confronted with the pension problem.

The other day Mr. Cammack in a little conference kindly told us that no company had a satisfactory pension plan, or one with which plenty of fault could not be found. Mr. Little has just an-

nounced that the English systems are in his opinion the best, while Mr. Rutherford says that the general problems can be solved in a group policy. If convenient it would be of very great value to those companies who are continually confronted with this question if some of these gentlemen would present to us a practical proposition based upon the principles of the above suggestions.

In our own practical experience we haven't been troubled so much with the psychology of the problem as we have with the dollars and cents. A large number of employers have very benevolent ideas, but when the cost is presented nothing develops. Within the last few years there has been a general movement on foot to adopt pension plans for railroad employees, and if I sense the thought of railroad executives correctly, it is that if they can persuade the Interstate Commerce Commission to recognize pension payments as current salary disbursements, then the annual cost can be charged as a current expense. It is reasonably easy to get recognition of this conception now when the cost is not great, and once the principle is recognized, the future and not the present directors of the railroads may be confronted with a serious problem.

In our office we have made an attempt to present something salable to the public, and, as some of you know, it is nothing but the issuance of single premium deferred annuity bonds in small units and providing payment at age 65. I think at age 20 for males the premium is about $10 for each bond of $10, the idea being that the employer buys the bond outright and gives it to the employee as his contract. It is complete in itself. If the employer buys one of those each year, of course he is incurring an increasing expense, but this seems reasonable in the case of the older employees, and the employee knows that each year a $10 annual pension is accumulating to his credit and at the age of 65 if he has continued with the employer the total pension is $450. Larger amounts can of course be bought.

Recognizing the element of labor turnover, an employer need not commence to buy until an employee has completed some probationary period, say five years. Again, if when the pension plan is installed an employee is 40 years old, having rendered say 20 years of service, the accrued liability can be spread and larger bonds purchased over the ensuing years, so the employer by simply classifying his employees by age and duration of service can get a very definite idea of the final cost of the pension proposition.

Many employers will give an employee a cash bonus for Christmas and forget it. There are no conditions attached to it, and the employer doesn't expect any return if the employee subsequently leaves, and by that same token we expect that if the employer desires to give the employee one of these bonds he should relinquish an interest in it, and allow it to become the complete property of the employee. That harmonizes somewhat with the principle just announced where service was recognized and the rights therein accrued to the employee.

The writer says: "Pensions are sometimes called 'deferred pay' but it is difficult for an insurance company to admit the 'deferred pay' principles and handle pensions like deferred annuities."

That seems to be just what we are trying to do, and while Mr. Cammack has told us that ours and other systems are not completely practicable we are still looking for the light. The author says further:

"Practically the employer cannot promise these pensions to the younger employees to hold them in his employ, for he cannot foretell the future development of the corporation, its subsequent management or policies, the gain or loss in the use of his particular product, economic disturbances affecting the value of the dollar or possibly the very life of the plant." Our contention is that each year he can at least purchase the accrued pension earned.

MR. M. M. DAWSON:

I have no disposition to make any remarks about the paper, though it seems to me to be a very good one. But I do feel called upon to say one or two things that are called out by some of the criticisms.

In the first place, I think that we actuaries are doing a purely mathematical thing, and not living up to the expression "actual" which should be regarded as an important feature of our title, when we say that old age service pensions are in any such sense deferred pay, as that they are virtually intended by the donor to be equivalent to an addition to the pay each year the employee is in service. That, in my opinion, is precisely the same thing as if you were to say that, when I order a suit of clothes from my tailor, I make myself responsible for paying for each stage in that process, even though the suit of clothes be never finished and delivered to me. The thing which the donor really intends to pay for by old age and service pensions is precisely the thing that you would pay for if you had an old servant who had remained with you until entirely disabled by age. It is a recognition of an increment of value of service long-continued, growing out of its faithful character, and it is only mathematically true and not actually true that it is fairly convertible into an increase of the current wages.

The difficulty which Mr. Craig is encountering in promoting his plan, which is very admirable and ingenious, is that employers do not wish to grant pensions, in part or in whole, to employees who are not in their service for a long time, nor indeed usually at all unless they continue in their service until incapacity on account of old age takes place. That is the truth about it. And under any of these so-called increased wage plans or deferred wage plans, such an employer is called upon to pay a vast amount of money over and above the cost of providing, as they have in mind, only for old and faithful employees. That is precisely the reason why they do not wish to go into it.

MR. HENRY MOIR:

I would like to point out with regard to what Mr. Dawson said on deferred pay, that if a pension is promised by a large corporation, then, whether we call it deferred pay or don't, economically it becomes deferred pay. I think the speakers were accurate to that extent. The situation is entirely different when you deal with an old servant or with the individual question where no legal obligation exists; but from an economic standpoint there is no doubt but that it always becomes deferred pay when the pension is promised by a responsible party.

MR. M. M. DAWSON:

I might say then that even in that case, it is deferred pay, contingent upon continuance in the service for that length of time. If the employee continues in the service until he is, for instance, 65 years of age, he will then go upon pension. So it is entirely contingent upon his being still in the service when he reaches that age.

MR. HENRY MOIR:

Modern pensions are developing along the line that even if employees resign they are entitled to something. This development has become necessary because of the economic condition that the pension is, whether you call it so or not, a form of deferred pay.

MR. ROBERT HENDERSON:

I think the situation arises from a question of practical politics. If the employer has promised a pension and should discharge an employee who has given a considerable number of years' service, no matter how well merited the discharge may be, he fears to create the impression that he is discharging in order to avoid payment of the pension, and therefore he would naturally feel inclined to a certain extent, unless he can make positive charges, to give some allowance to the discharged employee for length of service. That being the case, he cannot very well discriminate against the employee who has given good service and whom he would be glad to retain.

MR. A. D. WATSON:

I should like to suggest in lieu of, or as an alternative to, any cash return which may be made in event of voluntary retirement under almost any type of pension scheme the granting of, what may for present purposes be described with sufficient accuracy as, "proportionate paid-up benefits" payable in the same contingencies as benefits are normally payable under the scheme. In event of retirement after only a few years' service the paid-up benefits would be small, and, being in general fairly remote, a cash return,

even of considerably less present value, would generally be more satisfactory to all concerned. It should be possible to so adjust the cash return—say, contributions without interest—that it would as a general rule be chosen by those retiring in early years of service, while those retiring in later years would as a rule choose the paid-up benefits. If the full paid-up benefits should be thought too large, a reduction could be made, say, depending on the remoteness of the ultimate retiring age under the scheme.

It has sometimes—now very seldom—been contended that no payment should be made in event of voluntary retirement as to do so is to encourage the retirement of those in good health, which is a subversion of a primary purpose of any pension scheme. This would be true were the cash return unduly large, but it must always be remembered that the sense of injustice engendered by anything savoring of harsh or unfair treatment may well nullify to a considerable extent the advantages normally expected from a pension scheme. There can seldom be any great advantage in holding an employee or an official against his will, by an arrangement or by a contract, when he is really anxious to leave. If the normal increase in pension rights with increase in length of service, the salary or wages paid, the work and the general condition under which it is carried on are not sufficient inducement to continuance with the employer, then there must be something radically wrong somewhere; and in such circumstances the wisdom of constraining the employee to continue by reason of forfeiture of pension rights is very doubtful. It not unfrequently happens that an employee after many years' service finds himself unhappily placed due, it may be, to the introduction of working methods and conditions differing from those with which he is familiar, or due to a reorganization in which a really suitable place can not be found for every old employee, or, perhaps, due to unfortunate personal relations. The retention of an employee in any of these circumstances can hardly ever be advantageous, yet even if the pension age may be a good many years removed he is liable to feel entire forfeiture to be a heavier sacrifice than he is prepared to accept; and so he continues an unfortunate misfit and a failure. The granting of paid-up benefits should relieve a considerable proportion of such cases, for some employees at least would be able to maintain themselves out of their savings and earnings until the pension age was reached, or until earlier permanent disability, when the benefits would become payable.

As an extension of the principle of granting paid-up benefits, a reduced immediate allowance might in some circumstances be warranted.

In establishing any pension fund, it is rather difficult to fix upon a suitable ultimate retiring age for all grades and classes of employees. It would seem the granting of paid-up pension rights should help solve the difficulty, for if the option of retirement with

immediate benefit were available at, say, ages 64 to 66, with paid-up benefits available at earlier ages, each employee would to a certain extent be permitted to choose the pension age most suitable to his particular case; and thus a much-needed flexibility as to the age at retirement would be introduced. The advantages in holding on to the "old and experienced employee" are usually much less in practice than one might suppose from the theorizing there has been in that regard.

Another advantage of granting paid-up benefits on voluntary retirement is that the reinstatement of an employee so retiring is much facilitated at a later time. Some institutions may have a prejudice to taking back an employee who once leaves. As a general rule it is a mistaken prejudice. A dissatisfied employee who has had a trial at something else, and is prepared to return, will likely be found more satisfactory than ever before; and his return may well have a settling effect on other restless individuals. In his absence he is not likely to think the worse of an institution which has granted him a paid-up reduced pension benefit, dependent on his period of service which will become payable in event of permanent disability or in old age.

For the above reasons I should like to recommend to your favorable consideration, however the primary benefits may be determined, and whether under the contributory or under the so-called free pension schemes, the adoption of some sort of paid-up benefits in event of voluntary retirement. The manifest fairness of such an arrangement should make a strong appeal to employees and give them a sense of freedom, the beneficial results of which would far outweigh any disadvantages.

MR. E. B. MORRIS:

Remarks heretofore made have omitted a very vital consideration, I believe, in this discussion. Mr. Williamson's paper refers to the services offered to employers by insurance companies of which services the pension element is only one. To be of service to the employer pensionwise the insurance company must be able to sell the proposition from the employer's point of view. Probably one of the main reasons why we have not been able to interest the employer more successfully relative to pensions is because of the high cost. The deferred annuity contracts or "baby bonds" as they are sometimes called, offered by certain companies cannot guarantee a rate of interest much in excess of 3½ per cent. Furthermore, if he buys these bonds outright for his employees, and his employees leave, the bonds involve a considerable expense to the employer with no results pensionwise, and it must be recognized that the turnover of labor at other than advanced ages is necessarily high.

If, on the other hand, the plan is presented to the employer

based on proper actuarial lines, by which he retains all pension funds until the actual pension age, such funds could naturally be invested at the rate of earnings of the employer. He may figure, for instance, that he is earning 10 or 15 per cent. in his business, which fact would naturally greatly cut down the provisions for pensions. The actuary from proper data can guide the employer as to the amount of funds which he should hold as a liability against future pensions. As his employees under the pension plan adopted arrive at pension age, the employer has two alternatives—first, he may pay the pension out of his own funds and call it reduced salary or wage if he so wills, or he may actually purchase of an insurance company a life annuity, the rates for which under these circumstances should be less than those quoted ordinarily to the public because of the removal of selection on the part of the individual. This latter plan has this merit—that the annuity is actually turned over to the employee and will be continued for life whether the employer continues in business or not; in other words, the employee is guaranteed a life pension which will not necessarily be true under the former plan.

I will admit that the investment of pension funds by the employer in his business is open to certain objections. Some will advocate that such funds be regarded as trust funds and separately invested, but if the investment is outside of the business, the chances are that the earnings thereon would be materially decreased and, of course, the employer's pension expenses increased. The fundamental consideration of the employer, however, is the granting of the pension benefit and the means by which the pension is provided is a secondary consideration.

The problem is perhaps somewhat complicated by the idea that the pension is only earned after a certain number of years of service and the attaining of a certain age after continuous employment. If the employer, for example, goes out of business, having promised a pension under the above circumstances, those in his employ at such time who have not reached the pension age would presumably be entitled to no further consideration—that being the chance which the employee necessarily takes. Theoretically, one might argue that under these conditions the employee had earned a part of the pension, assuming, however, that that portion earned would not be payable until he reached pension age. While certain arguments may support such a proposal, from a practical standpoint and especially from the employer's standpoint, I do not believe the arguments would hold water.

This point, however, should be made. In event the employer (who goes out of business) has actually purchased deferred annuities for his employees, the employer is actually out of pocket, whereas if the employer controls his own pension funds and goes out of business the reserves on those pensions not yet earned would naturally be released to the business and might under certain circumstances save the employer from the hands of a receivership.

I am drawing this picture from the employer's point of view for he naturally is one of the most interested parties, but it must be admitted that this is a practical point of view for the employer to take, especially when the employer realizes the amount of pension funds which may eventually accumulate.

Most pension plans distinctly provide that the plan is subject to discontinuance at the employer's discretion—legally a very important consideration, which is emphasized by this discussion.

The pension proposition as discussed appears to center around the fundamental question as to whether pensions are, or are not, in a sense a form of deferred pay or wage. Arguments legal and actuarial have been given supporting both sides of this question and it is not probable that the point will be immediately settled, but in connection therewith I would like to suggest this problem. Employer A in a certain town has made no announcement of pensions to his employees. His rival, employer B, in the same territory, manufacturing the same line of goods, and with an organization of about the same size, has announced pension benefits for his employees. The actual wages paid in the two factories necessarily must follow the same scale, under the conditions named, otherwise there would be difficulty in employment. One cannot readily conceive of deferred pay without some decrease in present pay—other things being equal—but, as stated in the above analysis, the schedule of pay of both employers A and B is the same. Employer B, it is true, may attract a better grade of employees because of his greater liberality, which presumably, however, does not stop with the pension plan but involves other plans for the benefit of his employees. From a business point of view employer B may figure that because he is enabled to improve the morale of his employees and thus obtain a better type, his pension plan, etc., are worth while and pay for themselves, which argument, if accepted, rather upsets the deferred pay reasoning.

(AUTHOR'S REVIEW OF DISCUSSION.)

MR. W. RULON WILLIAMSON:

The paper under discussion considered the insurance company's service to employers under four main captions—

1. Group Life Insurance
2. Group Territory Disability Insurance
3. Pensions furnished by the Employer
4. Individual Insurance and Annuity Purchases made by the employee through the employer.

The key to the difference of opinion brought out by the discussion may be the real distinction between blanket and individual protection. Blanket coverages may be considered those where the individuals protected are covered by formula, no election as to the

protection resting with the individual. Blanket coverages may limit themselves to the specific benefit under consideration, whereas individual insurances, in order to give complete justice to each individual who bears the cost, seem to involve cash values and other supplementary benefits.

An employer usually establishes certain broad benefits which he does not count as wages, such as compensation insurance, recreation grounds, or the publication of a periodical for the employees. The outlay for such activities is considered a legitimate charge against the business as a whole since such expenditures may improve working conditions, increase esprit de corps and through their indication of the employer's sincere interest in the employees as a whole bring returns worth the outlay. An attempt to assess against each individual employee, however, his share of this outlay as a recognized part of his individual wages would involve the consideration as to whether the employer could thus arbitrarily spend the wages of his employees in such a manner. I have considered pensions as such an activity chargeable against the business as a whole and not safely admitted to be a part of the wage contract.

A similar consideration as to principle is involved in the sale of Group Life Insurance. So long as the employer regards Group Life Insurance as a blanket protection for all employees, the cost of which is met by the industry, and definitely not a part of wages, blanket life protection is easily tenable and works out simply. When premium payment, however, is considered as assessable against each individual employee and indirectly so much wages, the simplicity of Group Life Insurance gives place to the difficulties involved in the issuance of individual life policies.

The proponents of contributory pensions and contributory Group Life Insurance alike assert with justice that unfortunate results would follow the complete elimination of personal responsibility for life insurance and old age income. The contributory plans suggested, however, usually fail to grant the benefits inherent in individual life insurance or individual deferred life annuities. The solution of a sharing of cost seems to me to be the combination of such definitely limited blanket protection as may be furnished by the employer (securing completeness of protection and the singleness of purpose thus possible), while requiring the individual himself to meet the necessary costs of adequate individual protection and securing the benefits available through such costs.

Where the employer grants a pension with payment guaranteed for the entire lifetime of the employee he can eliminate the inefficient old employee and secure a definite credit against the cost of the pension through the increased efficiency of the plant and the promotions made possible by the elimination of the older man. Wages are paid for current production only and the outlay for pensions is distinct—a charge for plant morale and efficiency.

The employer who admits the deferred wage basis of a pension

plan and yet establishes a so-called contributory plan is really on very dangerous ground for as Mr. Watson points out, once the admission is made that pensions are deferred wages the contribution made by the employer is also deferred wages and practically contributed by the employee out of his wages. If the employer still considers that his payment is not deferred wages he accepts practically the plan which I have outlined and is dividing his coverage into pensions granted by himself and individual savings for old age encouraged among his employees.

Mr. Rutherford's comment that group insurance costs at least as much as ordinary insurance involves the use of the term "costs" in a technical sense. My consideration of cost was from the standpoint of the employee, who, confronted by the distinction between a $10 premium for group insurance and a $30 premium for regular insurance, fails to understand the reasons for the difference in costs which are apparent to us.

The suggestions made in common by Mr. Little and by Mr. Rutherford that the employer who buys single premium life annuities will be suddenly swamped with increasing pension costs overlooks the fact that such a plan established with the aid of an actuary will involve a recognition by the employer that single premium annuities now purchased result from the working force of some decades earlier and that there will be growth in pension costs very roughly corresponding with the growth of the plant in earlier years. The charge for such pensions, however, cannot under the basis of pensions which I have assumed, be primarily regarded as a charge against the individual years of service and the outlay is warranted only so long as the charge for the elimination of the older men seems warranted in the increased morale and efficiency of the plant as a whole. I do not believe that pensions so established should be *promised*. The analogy of the old assessment companies is incorrect since in those concerns there was an actual ignorance of the possibility of future increase, while with the pension plans the employer will recognize the very strong probability of such increase when he begins his plan.

Mr. Davis suggests that in the standard contract issued to employees there may be a provision allowing monthly payments during employment only, premium payments subsequent to employment following the regular rules of the company issuing the contract. This suggestion is a good one and should be considered by any company initiating this form of coverage.

Mr. Davis also indicates a very practical requirement for the sale of the general insurance plan—that the agents must be men of unusual calibre, thoroughly familiar with the different types of contracts involved, and that it is doubtful whether the compensation earned by such men would adequately repay them for the time and labor spent. This criticism is a very pertinent one. On the other hand, there frequently seems a heavy competitive waste in-

volved in soliciting individuals for large amounts of insurance, while the much larger group of individuals capable of purchasing comparatively small contracts is completely ignored. I know of one very prosperous agent who is securing a satisfactory amount of compensation through just this type of solicitation. It incidentally brings him in touch with an occasional large policyholder as well. Many agents could wisely specialize in soliciting the small policyholder. Acceptable results may be anticipated from intensive solicitation in a field where competition is almost unknown.

Mr. Craig has discussed the single premium deferred annuity plan used to give pension benefits by the Metropolitan. While these contracts undoubtedly offer service to employers, the employer who has actual old employees to pension, and establishes the plan so that the employees now retiring secure immediately adequate pensions and in addition makes a contribution for all other employees over a certain period of service starts with a heavy initial outlay. He is apt either to cut down the immediate pensions or reduce the entire scale by spreading over too wide a field. Moreover as Mr. Morris outlines, the employer's funds are worth more in his own business than elsewhere.

The extent of the discussion after so brief an opportunity to consider the paper itself indicates a very broad interest in the subject. I remain impressed by the scope of the field still available for the life insurance agent in marketing his goods.

Changes in Policy Contracts.

BY

JOHN S. THOMPSON.

Since the presentation of Mr. William Young's comprehensive paper on "Treatment of Cases of Alteration of Life Insurance Contracts" (Vol. XI, 465) and the discussion thereon, little has appeared in the *Transactions* bearing on this troublesome question. Some phases of the subject very properly dealt with at that time (1910) have become of less general interest; for example, little deferred dividend business is now written in the United States and that issued prior to 1907 is now so old that both the desire of the insured to make a change of plan and the advisability of changing are greatly diminished. On the other hand, the introduction of disability benefits and of additional accidental death benefits has brought before the actuary some new problems which, as a matter of course, were not referred to in 1910 because of the then restricted use of these special benefits. Possibly these circumstances justify some observations on this subject at the present time. In what follows, only annual dividend business, other than term, will be considered unless otherwise stated or implied in the context.

General Considerations.

Any change which is to be made will preferably be to some form of policy which is similar to other policies issued at the same date as the original contract. This will insure convenience in later dealings with the changed contract and precludes a resort to the methods adopted by some British companies of determining a new level premium from the date of change such that, on a suitable basis, the present value of future benefits under the contract less the present value of future premiums shall be equal to the reserve accumulated under the original contract. This course, especially when applied to limited payment life and endowment contracts, introduces an almost limit-

less variety of classifications—a circumstance of which the actuary would be immediately conscious when arranging for a grouped mean valuation but which causes little if any disadvantage when premiums and sums assured are valued separately and a reversionary bonus method, instead of the contribution method, is used in the distribution of surplus.

It may be said that changes from original date may be approached from two points of view: (1) the gross premium, or (2) the reserve. In considering the relative merits of these, it is necessary to state briefly some fundamental principles.

The conduct of a company's business consists in the receipt of premiums and of interest on the invested funds and the payment of claims and expenses. Each fiscal year the company is found to have earned a certain profit, part of which is distributed equitably among the policyholders (and stockholders, if any) and the remainder of which is added to the "unassigned surplus" or "contingency reserve." The dividends set aside for equitable distribution among the policies are such that the desired addition can be made to the contingency reserve and, at the same time, the regular reserves maintained upon the business in force. In other words, after the payment of claims and expenses further payments—dividends—can be made, which do not interfere with the requisite normal additions to the reserve and the desired additions (positive or negative) to the undivided surplus.

It may be taken as axiomatic that

(*i*) if the change is such as to require payment of cash by the insured to the company,

(*a*) the payment shall be at least equal to the difference in reserves maintained, so that there shall be no direct strain on the company, not compensated for, and

(*b*) the payment shall be at least equal to the difference in cash values so that the insured may derive no advantage from changing before surrendering, if termination of the policy is contemplated, and, similarly,

(*ii*) if the change is such as to require a payment to the insured, the payment shall not exceed either,

(*a*) the difference in reserves, or
(*b*) the difference in cash values.

The details of the calculation of the cost to exchange may go farther and, in addition to the adjustment of the reserve, may provide for

(i) adjustment of expenses,
(ii) adjustment of dividends, and
(iii) adjustment of undistributed surplus.

Expenses: The company's attitude on this point will be determined largely by the agency superintendent who should be governed by the degree of service rendered by the agent in connection with such transactions. These services are of minimum utility if the initiative, in the majority of cases, is taken by the insured and the details worked out with reference to the head office; they are of undoubted value and should entitle the agent to compensation if he is instrumental in conserving business which would otherwise go to some other company or lapse altogether.

Dividends: The ability of the company to equitably adjust for differences in dividends on the old and new plans, will depend on whether, in the exchange, provision has been made for adjustment of those elements which enter into the calculation of the dividends. For example, if the cost charged is an accumulation at compound interest, the adjustment for the difference in the interest elements of the dividends allotted will be equitably possible or impossible according to whether, in the accumulation, the dividend interest rate or the valuation rate is used. Similarly, with regard to the profit from loading. But with reference to the mortality element, the difference between the amounts at risk on the two plans is automatically taken care of, with the change in the reserve.

Undistributed Surplus: To include an adjustment of this item in the determination of an equitable cost to exchange requires a detailed analysis of all sources of profit as affecting various plans, ages at issue and calendar years of issue. The way in which this may be done has been pointed out very clearly and completely by Mr. Young in his paper above referred to. There are, however, two circumstances which may

justify the company in omitting to introduce any adjustment of this item:

(i) The profit transferred to or from "undivided surplus" is, except in very abnormal times, only a small proportion of the total profits earned so that the equitable "share" of each policy would ordinarily not be more than a small fraction of the dividends actually allotted and the difference between such equitable shares of the original policy and of the new policy would be very small indeed;

(ii) The proportion of policies changed after being issued and paid for is small; in one large company the policies rewritten daily because of change in plan amount in number at the present time to about 2 per cent. of the number of policies sent out as new issues, and the changes in a year are about ½ per cent. of the business in force which is 10 years old or less; it appears inconsistent to determine surrender-values in relation to reserves rather than in relation to "asset-shares" and develop "asset-shares" for use in connection with changes, a relatively unimportant item.

Change to Higher-priced Plan.

If a company charges the difference in net reserves, it is charging the difference in net premiums, carried forward, with "benefit of survivorship," at the rates of interest and of mortality assumed in the calculation of net premiums and reserves. This is the *minimum* charge; any expenses incurred in connection with the change and paid for by the company should be added. The *maximum* charge which could be made would be the accumulation of the difference in gross premiums with "benefit of persistence" (that is, allowing not only for those who die but for those whose policies are otherwise terminated) and at the effective net rate of interest earned by the company on its funds. In this latter case, the company would be collecting the entire loading, forborne from original date of issue, and as the interest rate charged has been the net rate earned, the company would be in a position both to pay to the agent any difference of commissions in favor of the new plan and to pay to the policyholder any excess of the dividends on the new policy over those allotted to the old. In practice it is usual to

charge the difference in gross premiums accumulated at compound interest at a rate at least equal to the dividend interest rate. This is assumed to yield sufficient in excess of the increase in net reserve to justify the company in making adjustments of commissions and dividends, and doubtless this assumption is warranted in a large proportion of the typical cases coming up for change, but in case of policies issued at the higher ages or, even in case of those issued at the lower ages, if they have been a number of years in force, a deficiency may arise if all the adjustments are made. One advantage of this mode of procedure is that it is acceptable to the insured as a simple and fair means of placing him, apparently, in the same position as if he had originally taken the policy to which it is proposed to change. He will, however, be much less likely to complain of a possible overcharge if he is making the change soon after issue and the policy was issued at a low age, than if he is charged a rate of compound interest considerably higher than 6 per cent., although this rate may be merely sufficient to establish the additional reserve, thus causing the company to pay out of surplus any incidental expenses that may have been incurred and paid. It is difficult to see that there is any great lack of equity in calling upon the insured to pay the increase in reserve (or increase in cash value, if greater) and to pay in addition any charges that it may appear wise for the company to make as a matter of general practice.

Change to Lower-priced Plan.

Notwithstanding the difficulty of establishing a simple method of changing to a higher-priced plan which shall be reasonably equitable and equally fair for all durations and ages at issue, it has been even more difficult to find a parallel method for the reverse type of change. The nearest approach to the common method of changing to a higher-priced plan, would be to refund differences of premium with interest less the difference in the cost of insurance and less any sums required for adjustment of expenses and dividends, but this method abounds in difficulties and so far as is known has been avoided in practice. A method of doubtful value which has been used to some extent is to change the policy to one of such larger amount that the gross

premium is the same after as before change. (This new amount may be considered the maximum to which the policy can be changed from original date.) Under this arrangement, it would be possible for the company to adjust commissions and dividends but the method has the serious disadvantage of charging the insured for an amount of insurance equal to the increase, say $\$S$, which he has not enjoyed. Hence, if only the original amount of insurance is desired, it is necessary to surrender the portion $\$S$ and the surrender value of that part is clearly less than the amount to which the insured is equitably entitled. A slight variation of this method is to consider the original policy to consist of two parts: (1) a policy of such amount that the original annual premium thereon is the same as the annual premium on the whole of the original policy at the new (lower) premium rate, and (2) the remainder (of the original policy) which has an annual premium at the old rate equal to the annual premium at the new rate on $\$S$. Part (2) may either be continued (if not too small) or surrendered; if surrendered, its surrender-value will usually be larger than the surrender-value of the portion $\$S$ of the new insurance arising under the change, so that in such a case, it would be more advantageous to deal with the change in this way if the continuance of only the same amount of insurance were contemplated. To avoid the inconsistencies and difficulties of these methods, there has arisen the practice of allowing the difference in reserves (or of cash values, if their difference is less) whether the change is to a policy of the same amount or of the maximum amount. Theoretically, this will not permit the payment of any differences in commissions or in dividends and should be diminished by such adjustments as it is deemed advisable to undertake as a matter of general practice.

Change before Policy has Cash Value: Obviously, in case of change to a cheaper plan, a change in the early policy years before the policy has acquired a surrender value, requires special consideration, inasmuch as the allowance of the difference in reserve in cash discriminates against the persistent policyholder in favor of the unsettled, dissatisfied one. When, therefore, such difference of reserve is offered in consideration of a change in the contract, it should be as a special "conversion" value

and dealt with in such a way as to insure the continuance of the policy—but with the requirement that at least a portion of the premium must be paid in cash until the stage has been reached when a regular cash value exists, lest the change develop into a term extension,—for by hypothesis the policy is assumed to have no surrender value of any kind at date of change. It would be necessary to reduce this reserve allowance by the excess, if any, of the commission already paid over that which would have been paid had the new plan been taken originally; on the other hand, if the commission on the new plan is greater than on the old and it is intended that the excess shall be paid to the agent at the time of the change, that excess should be deducted from the reserve-difference allowed.

This liberal treatment of young policies has its justification in the fact that it may assist in conserving a company's business when financial or business conditions prevent the continuance of high-priced policies taken out in a period of inflation or conspicuous prosperity.

The Reserve.

It is believed that no serious inequity will result either to the insured or to the other policyholders if the difference in reserves is made the basis of the change in either direction. This offers a method which is precise in its application, does not require modification from period to period on account of changing conditions (the annual dividend scale should perform that function) and is readily applicable to all plans and benefits, even the most complicated.

Joint Policies.

These general principles may be applied without fundamental variation to cases in which the plan of insurance is changed but the insurance continued upon the same group of lives. It may be mentioned that the deficiency of the accumulated difference of premiums in case of change to a higher-priced plan under the common rule will be accentuated because of the high value of the forborne annuity for a group of joint lives. For example, at age 53 at issue, the difference between the American 3 per cent. Ordinary Life and 20-Payment Life

net premiums accumulated at 5 per cent. compound interest is just sufficient to make up the difference in 5th year terminal reserves; in case of two lives (Makehamized American 3 per cent. basis) these accumulations are insufficient to establish the reserve for ages at issue over 35 and in case of three lives, these 5 per cent. compound interest accumulations are always insufficient.

The more usual demand will be for some readjustment of the group itself, with or without a change of plan.

A joint ordinary life policy for $\$A$, on, say, three lives x, y and z may be considered as constituted of three contingent assurances, one for $\$A$ on each life against the other two. If these are changed to absolute assurances for $\$A$ each on each of the individual lives, the excess of the sum of the new reserves over the reserve on the original policy could be charged or the ordinary rule might be applied by accumulating the excess of the sum of the new gross premiums over the old gross premium, subject to verification of the sufficiency of the resulting amount. A similar change, say, to one for $\$A$ on the single life (x) and another of $\$A$ on the joint lives (y) and (z) could be treated along the same lines. In such cases, no policy can, of course, exceed the original in amount and the maximum amount of insurance is obtainable when the change is to single life policies, one on each of the lives and each for the original amount. If the change is to individual policies of smaller amount, no new principle is introduced; under these circumstances, only a portion of the original will enter into the change, leaving a portion to be surrendered. The difference in reserves (or cash values) automatically takes care of any reduction from the original amount. For example, if the change (to use the former illustration) is to $\$A/3$ on each of the three lives, there will be a payment of difference in reserves (or cash values) to the owners of the policy.

A rather unusual type of change came to our attention recently. A joint policy had been issued as a corporation policy on the lives of three officers of the corporation and a short time ago, after the policy had been in force about one year, a request was made for permission to substitute a fourth life for one of the insured three who wished to withdraw from the company. It was pointed out that this was plainly a case of dating

back the insurance on the new life but as the agent in the case was insistent the question was submitted to the Oklahoma Commissioner of Insurance, who ruled as follows:

"Under Section 3471 of our Insurance Laws (the statute against "dating back") the case as outlined by you would be a technical violation but I am sure that the writers of this chapter did not intend to reach a case like the one in question and we therefore feel that, where the assured desires to make this change and the company is willing to comply with their wishes, this Department should not interfere in the matter."

It is impossible to say what might be the attitude of other Commissioners and Superintendents on this point.

Disability Benefits.

Changes usually arise in one of two very similar ways:

(1) The attachment of benefits to a contract previously without them, or

(2) Modification of existing benefits without a change of plan or modification of benefits as a consequence of change of plan or a combination of these.

In the establishment of benefits for the first time there are three possible methods:

(i) to charge all premiums from original date with interest,

(ii) to charge the net reserve,

(iii) to compute a new level premium from attained age.

(i) When no allowance is made for carrying the risk as in the case when all overdue gross premiums with interest are charged, the cost to attach the benefit is excessive. The inappropriateness of this course is particularly obvious in case of policies issued at the higher ages and of endowment policies issued at all ages, where the temporary nature of the benefit is more in evidence and proportionately more of the level premium is devoted to the payment of claims. Under these circumstances, the charge even for short durations would be several times the reserve. The relation between the annual premium and the cost of carrying the disability risk for certain of the early policy-years (on the basis of $1,000 policy) is shown in the following table in connection with a disability clause providing for (*a*) waiver of American 3 per cent. net premium, and (*b*) an an-

nual income of 10 per cent. of face of policy commencing on the second anniversary after disability:

	Ordinary Life Ages at Issue.			20-Payment Life Ages at Issue.			20 Yr. Endowment Ages at Issue.		
	20	35	50	20	35	50	20	35	50
Net Annual Premium.....	$0.71	$1.17	$2.35	$0.94	$1.24	$2.37	$0.32	$0.67	$2.23
Cost of Disability Insurance $(= vp^{ai}_{x+n-1} \cdot K^*)$									
1st year.....	0.28	0.59	1.57	0.30	0.62	1.62	0.33	0.64	1.61
5th year.....	0.36	0.71	2.16	0.38	0.74	2.20	0.39	0.72	2.12
10th year....	0.46	0.94	3.86	0.47	0.95	3.79	0.40	0.80	3.28

(ii) The difficulty explained in connection with (i) is met by charging the reserve and requiring all expenses to be met by the applicant. In computing the reserve, the company may either: (1) use the reserve at the preceding anniversary and charge the full gross premium for the current policy year, or (2) more equitably, use an interpolated reserve and charge only the proportionate premium for the unexpired portion of the current policy-year.

(iii) The objection to making no charge in a single sum at date of change but charging a new level premium as of attained age to cover the benefits offered is the same as that which has led to this type of change having been consistently avoided in connection with all changes of plan, namely, the complexity of the policy-groups and the consequent difficulty of making accurate valuations. Since the amount required to make the change as of original date is not large, it is difficult to see what advantage accrues to either insured or company from the use of this method instead of that of calling for the reserve and the tabular annual premium as of original date, unless the limitations of the company's charter prevent these special benefits from being dated back more than a few years. As to the valuation of benefits carrying such special premiums from attained age, it may be noted that if the reserve be set up as if the benefit had been issued as of original date, the company's liability will not be understated.

* K is the present value at the end of the year of disability of the benefits payable, on basis of Hunter's Disabled Lives Table, 3 per cent. Interest.

In case of change of benefits already attached to a policy, whether this change be due to change in the plan of insurance or change in type of benefits or both, there are two possible courses: (i) to charge differences in back premiums with interest, or (ii) to charge the increase in reserve. The same considerations govern as those explained above in connection with the introduction of benefits as from original date but the inconsistencies, where they exist, are less marked as only the differences in the benefits are involved. If the reserve for the new benefit is less than for the old, no allowance should be made.

Additional Accidental Death Benefits.

To this feature the same general principles will apply, that is, to establish the benefit it will be necessary to charge the reserve, and to change the plan, the difference in reserve. If, as is commonly the case, the risk is considered the same for all attained ages, the rate for ordinary life and co-terminous endowments will be the same for all ages at issue. When, therefore, this accident benefit is to be attached to these forms of contract, it will be necessary to charge merely the fractional premium for the unexpired portion of the current policy-year. If, however, the benefit is to be added to a limited payment life or endowment policy, there must be charged in addition the difference in reserve, which may be taken as the excess premium over the level cost of carrying the risk, accumulated for the proper period (see *Transactions*, XIX, 85). If the reserve on the new plan is less than on the old, no allowance should be made.

Medical and Other Requirements.

Life Insurance Policies. The risk for the year immediately following the date of change is measured by $q\ (A—V)$ where A is the face of the policy, V the reserve thereon and q the probability of the policy becoming a claim within the year. It will be increased if q is increased or A is increased or V diminished. Medical examination will be required to insure against q being increased by selection when changes in A and V have been compensated for. (In rare cases, as when a contingent assurance is made absolute, q will be increased as a consequence of the change of plan, even if the normality of the continuing risk is

assured.) If because of increase in amount of insurance or decrease in reserve or both, the amount at risk is increased by $\$S$, the medical and other requirements should be the same as for the issuance of $\$S$ new insurance, ranging from the "certificate of health" or similar abbreviated medical examination to one or more full medical examinations with detailed inspection as to finances, moral hazard, etc. Furthermore, when the amount of the policy is actually increased, the company will desire to be protected as to suicide, incontestability, etc., to the same extent as if it were issuing an amount of new insurance equal to the increase. This protection can be obtained by having the insured and others, if any, interested, sign the following agreement:

"As one of the considerations for the change of this Policy from a ———— Policy for $———— to a ———— Policy for $———— and for the increase in the amount of the Policy it is agreed that as regards the $———— by which the amount of the Policy is increased, the provisions contained in the Policy as to Suicide, Incontestability, etc. . . . , shall be effective from the date of such increase as if such were the date of issue of said Policy."

In case of a joint policy, to be subdivided into individual policies of such amount that their total is equal to the face of the original joint policy, it will scarcely be necessary to require detailed evidence of insurability, even though a difference of reserve may be paid out or allowed in payment of future premiums, since no advantage against the company will accrue from selection exercised by the insured unless all the lives are seriously impaired; to guard against this, a "personal certificate of health" will probably be sufficient. In most cases the insurance will be divided equally among the lives and under such conditions the requirement of anything more than nominal evidence of insurability may safely be omitted. If the insurance is not evenly distributed, care should be taken to see that the face of the largest single life policy falls short of the face of the original policy by an amount at least equal to the sum of the reserve released and the surrender values of the other policies; if the largest policy does not comply with this limitation, full evidence of insurability of the life carrying this portion should be required.

Disability Benefits. As in the foregoing case, satisfactory

evidence of good health should be required when the disability insurance is increased. The old and new benefits may be compared from two points of view: (i) the amount of the income provided for, and (ii) the values of the respective incomes, according to the Disabled Lives Mortality table, if disability should occur at once. For example, the change from ordinary life to a limited-payment life contract a few years before the end of the premium paying period would increase the annual income to be paid in the event of the disability but would possibly decrease the amount to be incurred as a disability claim. Selection, however, might be exercised so effectively as to make the benefit, the value of which was apparently less according to the standard table (Hunter's Disabled Lives), the more valuable of the two, and hence, because of the interworking of three influences—rate of disability, rate of mortality after disability and rate of recovery—evidence of insurability should be required when the income is to be increased even if the income on disability be only temporary. This evidence might properly take the form of a brief "certificate of health" in case of small increases in income but for any substantial increase in benefits, a full medical examination should be required, in all cases, free of expense to the company.

Additional Accidental Death Benefits: Since this is an accident benefit, evidence would be required as to any circumstances of insured conducive to fatal accidents. Generally, a statement as to occupation will be sufficient although there are some medical impairments, resulting in increased hazard, which might have arisen since the initial examination, such as impairment of vision, loss of or injuries to foot or leg, history of dizziness or fainting, history of nervousness, etc. Information as to these can usually be acquired without the formality and expense of a full medical examination.

Discussion of Preceding Paper.

(WRITTEN DISCUSSION.)

MR. H. N. SHEPPARD:

Mr. Thompson in his paper refers to the British method of determining a new level premium from the date of change as a method to be avoided. The basis of his objection is the difficulty of meeting the cases of special contracts for valuation and dividend purposes. The question at once arises why should a company that has enough business on its books to make a group valuation method advisable, not be able to give as good service to its policyholders as a small company that values each policy separately?

With the idea in view that full service should be given to policyholders, I propose to consider a policy that is changed in plan in the course of its history, without a change in sum insured, merely as a case of a policy issued with irregular premiums. The method of loading each premium should be made to conform with the general methods pursued by the company. The company with which I am connected will, upon request, endorse on any new Ordinary Life Policy an option, to be exercised only at the end of five years, under which the policy may be changed to a policy paid up at the end of twenty years from date of issue. The premium charged after the first five years is greater than the twenty payment life rate at date of issue by an extra premium, the net value of which is the difference between the reserves on the two plans at the end of five years divided by the annuity due for fifteen years at the attained age. To this the standard loading for level premiums is added—viz.: one-eighth of the net, the loading of one-eighth of the ordinary life net being already contained in the twenty payment life rate. In other words, we can consider the policy as a continuous contract, the net premium for the first five years being the ordinary life rate, then for fifteen years being greater than the twenty payment life rate. To each net premium is added the standard loading of one-eighth of its own net and one-eighth of the ordinary life net.

The next step is to consider the same policy changed at the end of five years from date of issue, the insured if he lives so long paying in all five ordinary life and fifteen twenty payment life premiums and an extra payment with the sixth premium. It seems to me logical to base this extra charge on the difference of reserves with a loading for commissions and taxes, allowing to the agent as commission the same percentage of the extra charge as would be allowed in the case of a single premium policy, assuming of course that no mortality gains form part of the agent's commission in such cases.

There is, however, a practical advantage in basing the charge during a short period at least, on the difference of premiums with interest less the difference of dividends, taking care, however, that if the charge is guaranteed in the contract on this basis there is a limitation that the charge shall not be less than the difference of cash values. The reason for this has been pointed out by Mr. Thompson. I believe a workable compromise would be to use this method for five years, the method previously suggested for the following ten years, and after the end of fifteen years base the charge on the difference of reserves with a loading for State Tax, allowing no commission to the agent.

The methods above outlined avoid the confusing question of asset shares. Mr. Thompson refers to the greater difficulty of making the proper charge when changing to a lower priced than to a higher priced plan. I believe we can make our methods of meeting the former kind of change harmonize to a certain extent with our methods of meeting the latter when we bear in mind the various points involved.

Referring to Mr. Thompson's paper, it is now axiomatic that we must not allow more than the difference between the reserves or more than the difference between the cash values.

The next point to consider is—

(1) Will the smaller of these differences be paid to the policyholder in cash?

(2) If not paid in cash, will it be held as a fund out of which future premiums on the policy are to be paid as they fall due until the fund is exhausted?

(3) Will it be applied to reduce all future premiums?

It is a question of judgment which method is to be followed, but when a particular method has been chosen we must carry it out logically. If the first method is followed the greatest deduction that can be made from the difference of cash values (if chosen) is the actual cost of putting the change through the company's books, as this alone could be defended if the policyholder decided to surrender the new policy after the change was completed and before a payment was made on the new policy.

If the second method is followed, where the company refuses to pay the insured cash when the change is made, any excess of outstanding loan over the maximum loan on the new policy must be repaid in cash, otherwise cash may be obtained indirectly through the higher loan value of the original policy.

The third method harmonizes with the method above suggested for changes for higher priced plan, the contract being considered as a continuous contract with irregular premiums. If the reverse change is made to that described in detail above, the rate charged for life after the end of five years should be less than the rate for the ordinary life plan at the same age at issue, not only by the net

reduction obtained by dividing the difference in reserves by the annuity for life at the attained age, but also by the corresponding loading, namely one-eighth of such net reduction. Unless this were done there would be a lack of agreement between the rates of the company for different kinds of contract.

This method does not involve re-payment by the insured of any excess of the outstanding loan over the maximum loan on an ordinary life policy for the reason that the reserve is continually increasing, but not so rapidly as if the policy had remained unchanged. The change involves calculations of special cash and paid-up values.

I have confined myself to a discussion of the two classes of change most frequently met with in practice in order to keep it within reasonable limit.

(ORAL DISCUSSION.)

MR. JAMES E. HOSKINS:

Mr. Thompson's paper nominally deals with changes in annual dividend contracts, but his work in bringing up to date the literature of this subject is of almost equal value to those who have to deal with changes in non-participating contracts. There are some interesting problems in the changes of non-participating contracts to a lower priced form. Usually these changes are made by crediting the difference in cash values. This conforms to Mr. Thompson's requirement that the credit should not exceed the difference in cash values or the difference in reserves. The surrender values of most modern non-participating policies are a graded percentage of the reserve, graded according to duration but independent of form, and consequently the difference in cash values will never exceed the difference in reserves.

There are at least three reasons why crediting the difference in cash values is a logical method. One of them is the reason suggested by Mr. Thompson that the credit should not exceed that difference because if it did the policyholder who intended to surrender could obtain a larger surrender value by changing and then surrendering. Whether many laymen or even agents would think of such a complicated maneuver is perhaps an open question, but there is the possibility.

Another reason is that it appeals to the policyholder as logical because he recognizes the cash value as the value of his policy, and he recognizes in life insurance as in any other business that if an article worth $300 is changed for one worth $200, then $100 in money should pass to balance the transaction.

The third reason, and perhaps the most important, is that in modern non-participating policies the cash value rather closely represents the asset share or amount of money which the company actually has in hand after paying expenses and accumulating the

remainder of the premiums with interest. There is reason why the company should credit practically the full amount of the asset share, because these changes are usually made to keep on the books policies which would otherwise lapse, and it is therefore undesirable to regard such changes as a source of profit; maximum credit should be given.

If request is made for such a change during the year at the end of which the policy first acquires a cash value, it is possible to postpone the adjustment to the end of the year, but it is hard to explain such a procedure to the policyholder. He can't see why a change shouldn't be made at once if he is in a position to supply the necessary evidence of insurability.

If the cash surrender value at such a time is figured as the amount which could be obtained as the proceeds of a loan, that is, the cash value at the end of the year less loan interest,—and this will generally exceed the value obtained by pro-rating between zero, the value at the beginning of the year, and the cash value stated at the end of the year, with proper allowance for unearned premium,—then crediting the difference in cash values so obtained will again give a close approximation to the difference in asset shares.

If when the policy has a cash value you make such a change by crediting the difference in cash values, then in the years before it acquires a cash value you cannot consistently allow the difference in reserves, which ordinarily would be greater, at least when the reserve is a full level premium reserve.

A method suggested by Mr. Young in his earlier paper on the subject is a very good one for this purpose. That is what is known as the debit and credit method, crediting the premium paid on the original contract, debiting the commission; debiting the premium on the new contract, and crediting the commission; and this in the earlier years—although not over any great length of time—gives a fairly close approximation to the difference in asset shares, and is reasonably consistent with the credit given when the policy acquires a cash value.

In the first year of the contract, or shortly after its issue at least, the difference in commission should be debited against the agent rather than against the insured, because obviously if such a change is made just after the policy has been issued, it means that the original policy was poorly sold even if it was sold in good faith.

MR. S. MILLIGAN:

In the company with which I am connected a large volume of changes go through, and it is necessary to lay down explicit rules, as a great amount of the detail work is done outside of the Actuarial Division. There seems to be a tendency to get tired of operating under any particular set of change rules, and suggestions for change of method are continually being made.

Mr. Thompson's paper was very opportune in that its arrival was coincident with the receipt of a critical memorandum on our change system prepared by some of the non-actuarial members of our change force. Our present method is very similar to that outlined by Mr. Thompson. He intimates in his paper that possibly some departure from the difference in reserves method should be used in the early policy years. Mr. Hoskins outlined such a procedure a few minutes ago. Our practice is to use a debit and credit method when the policy offered for change has been less than three years in force. After three years changes are made on the difference in reserves. If there is a credit to the insured on the difference in reserves method and that credit is more than the difference in cash values, all we will allow in cash is the difference in cash values, and the difference between this latter amount and the difference in reserves we credit towards the payment of future premiums under the policy. Of course there are some changes, like changes in age, which require somewhat different treatment from that accorded changes in the kind or the amount of policy.

In regard to the changes incident to the disability and double indemnity provisions, our practice is the same as proposed by Mr. Thompson.

MR. E. E. RHODES:

Possibly a statement of the Mutual Benefit's practice may be of interest, although I am not on very sure ground, and if I err in any statement I hope that Mr. Riley or Mr. Tebbetts will correct me. I think that after a policy has been in force for three years we will make a change on the basis of the difference in reserves, having regard, of course, to the cash values. On those changes we do not adjust past commissions. We do not consider that the agent is at all responsible for the change, and he gets no compensation for it. He will get a renewal commission if it is within the term in which renewal commissions are paid on the basis of the changed policy, but that is the only increased compensation that the agent gets, and it is a source of surprise to me to learn that some companies are paying out commissions which in my opinion are not earned. In the early years we make the change on the difference in premiums, and whenever the change is made on that basis, the commissions are adjusted, but not in any other case.

MR. O. W. PERRIN:

Notwithstanding certain theoretical objections to the second method suggested by Mr. Thompson for the addition of the disability benefit, the Penn Mutual has found this method to be a very good one in actual operation. Our practice is to grant the disability benefit to all policies issued since the date of its adoption upon request, but always to date it back to the original date of issue of the policy. The small cost of paying for putting up the

disability reserve is partially offset, as a rule, by the slightly lower extra premium as of the original age as compared with the attained age and this, we find, is a more helpful feature in reconciling the policy holder to payment of the cost of dating back than any explanation of the technical complications that make the addition of the benefit at the attained age difficult to handle.

(AUTHOR'S REVIEW OF DISCUSSION.)

MR. J. S. THOMPSON:

Mr. Sheppard has referred to a variable premium policy. If such a policy were issued and offered as anticipating some optional changes at the end of five, ten or fifteen years—somewhat in the manner of a "convertible policy"—the objection which I cited with regard to the practice of making such changes indiscriminately would not hold. If, however, such changes of ordinary policies occurred at any duration and, possibly more than once in connection with a specified contract, the situation would become rather complicated, and I doubt if any large company would care to undertake the periodical valuation of such a multiplicity of forms. For example, all companies have endowments applied for, issued and in force at almost every possible age at maturity and every possible term but, judging from the smallness of the odd groups the necessity of such a large number of varieties may well be doubted. For the same reason, it seems advisable to offer to change policies only to contracts which might have been issued at the original date and to avoid making changes after what may be called the British method. There is, however, one rather lame way of making the change on a level premium basis, and that is by making a suitable loan and amortizing it for the balance of the desired premium-paying period.

I thoroughly agree with Mr. Rhodes as to the advisability of not paying commissions after the policy has reached the age of, say, three years, but here, again, the services rendered by the agent would have to be taken into consideration.

I appreciate the value of Mr. Hoskins's remarks in rounding out the discussion by dealing with changes in non-participating policies and the further light thrown upon the subject by those speakers who told of the practices of their respective companies.

Experience Under Widows' and Orphans' Benefits in Pension Funds.

BY

DWIGHT A. WALKER.

As the *Transactions* contain no data or discussions bearing on the determination of contributions for or the valuation of widows' and orphans' benefits in pension funds it seems appropriate that the results of a recent study of the statistics underlying such benefits should be placed before the Society.

In the first part of the paper will be found the experience amongst the clergy of the Protestant Episcopal Church in the United States of America. The status as to the families was first prepared on the basis of living clergy but the record of all of the deaths which had occurred amongst the clergy from January, 1917, to about the end of 1921 was obtained and analyzed as to the family status at death. These latter results may be compared with similar results based on the living. The deaths are not necessarily complete for the months of January and February, 1917, nor for November, 1921, but this fact does not materially affect the results produced by the use of the deaths for the purpose for which they are employed in this study. I am not attempting to produce a table of mortality rates nor to check up actual mortality against expected nor is any attempt being made herein to take into account the effect on pension payments of the departure of actual salaries paid from those assumed in the salary scale employed originally in making the calculations. Of the 336 deaths seven were reported as having been due to war service. The influenza epidemic did not have a very great effect on the mortality of these clergy during the years 1918, 1919 and 1920 as will be seen by the analysis shown below of the deaths classified by time of death. I was unable to obtain the cause of death in each case or a definite statement of the number of deaths from influenza and pneumonia but was informed by one of the active officers of the Church Pension Fund that he knew of only a very small number of deaths that had been caused directly by the "flu." The medical officers

of the Fund had thought, however, that the large number of total and permanent disability claims had probably been caused by after-effects of the "flu." The number of deaths occurring in 1917 was 54 with possibly a few left out in January or February. In 1918 they number 64; in 1919, 68; in 1920, 75; in 1921, omitting December and part of November, 75. The approximate number of clergy exposed to risk was 3982 for 1917; 4030 for 1918; 4403 for 1919; 4809 for 1920; giving an average mortality rate of 13.6 per thousand exposed for 1917; 15.9 for 1918; 15.4 for 1919 and 15.6 for 1920. Leaving out the deaths in war service some of which may, of course, have been caused by the "flu," the ratio for 1917 was 13.3 and for 1918 was 14.4 per thousand. The periods marked with asterisks below unquestionably show the effects of the epidemic but not to any very marked degree.

NUMBER OF DEATHS AMONGST CLERGY CLASSIFIED BY TIME OF DEATH.

Year.	Period in which Death Occurred.	Number of Deaths in War Service.	Remaining Deaths.	Total Deaths in Year, All Causes.
1917....	1st Quarter	—	11	
	2d "	—	12	
	3d "	—	15	
	4th "	1	15	54
1918....	1st Quarter	—	13	
	2d "	3	13	
	3d "	—	9	
	4th "	3	23*	64
1919....	1st Quarter	—	25*	
	2d "	—	20	
	3d "	—	13	
	4th "	—	10	68
1920....	1st Quarter	—	27*	
	2d "	—	13	
	3d "	—	22	
	4th "	—	13	75
1921....	1st Quarter	—	29*	
	2d "	—	23	
	3d "	—	12	
	4th "	—	11	75
			Total.....	336

In the second part of the paper will be found data based on the family status of the employees of one of the large New York

banks. The experience as to deaths was not extensive enough in this case to make results obtained therefrom of very much value but it is thought that a comparison between the results obtained from the living with similar results based on the experience of the clergy will be of some interest.

A paper by Charles E. Howell was published in the *Journal of the Institute of Actuaries,* Vol. LII, pages 1–22, which gave the family status of the clergy of the Church of Ireland based on valuation data for the years 1906, 1911 and 1916. A comparison of this experience with that of the Episcopal Church in the United States indicates that there are fewer children under the former for the younger ages of the clergy while the opposite is the case for the older ages of the clergy. By examining columns (4) and (5) of Table I below it will be seen that this is due chiefly to the fact that marriages took place on the average at older ages in the case of the Irish clergy.

Part I.

The present pension plan of the Episcopal Church in the United States which is operated by an incorporated body called "The Church Pension Fund," was inaugurated on March 1, 1917, but the data employed in making the actuarial calculations was based on the family status of the clergy in 1913. Tables I (columns (2), (3) and (4)) and II shown below are therefore based on the families of the clergy living in 1913. The figures given in columns (2), (3) and (4) of Table I resulted from the graduation of the original data by a summation formula. It was thought that the probability of being married might be affected by the income received by the individual so that the value of $(h)_x$ was computed on the basis of the salaries received by the active clergymen as well as by the numbers of such clergymen. Column (3) was later used in the actual computations as it showed throughout, except at the higher ages, a greater probability of being married by salaries than by numbers.

Referring to Table II it may be noted that there were only 134 children listed under age 0 whereas there were 213 listed under age 1. This is accounted for by there being only a half-year's exposure for age 0 as the data was listed by age nearest birthday.

In Table III I have shown the status of the families of all of the clergy whether active or pensioners who died between January,

TABLE I.

Age of Member (Nearest Birthday) x. (1)	Episcopal Church in United States			Church of Ireland	New York Bank
	Age of Wife (Nearest Birthday) $y(x)$. (2)*	Probability (Based on Salaries) of Having a Wife Living $(h)'_x$. (3)*	Probability (Based on Numbers) of Having a Wife Living $(h)_x$. (4)*	Probability (Based on Numbers) of Having a Wife Living (Graduated) $(h)_x$. (5)	Probability (Based on Numbers) of Having a Wife Living (Graduated) $(h)_x$. (6)
21	21	.285	.257		.108
22	22	.306	.279		.164
23	22.92	.328	.301		.208
24	23.84	.350	.327		.244
25	24.71	.372	.350	.067	.279
26	25.53	.393	.372	.104	.316
27	26.30	.416	.394	.148	.357
28	27.05	.445	.421	.197	.402
29	27.78	.483	.456	.249	.453
30	28.50	.529	.498	.302	.510
31	29.23	.578	.543	.355	.581
32	29.99	.627	.589	.407	.654
33	30.76	.671	.631	.457	.724
34	31.55	.708	.668	.505	.785
35	32.35	.735	.698	.549	.833
36	33.15	.755	.722	.589	.848
37	33.96	.769	.741	.625	.849
38	34.79	.780	.757	.657	.840
39	35.63	.790	.770	.685	.827
40	36.50	.800	.781	.709	.814
41	37.38	.808	.770	.730	.816
42	38.28	.815	.799	.748	.822
43	39.19	.822	.807	.762	.831
44	40.11	.828	.813	.774	.842
45	41.06	.832	.818	.783	.855
46	42.02	.835	.823	.790	.865
47	43.00	.838	.826	.795	.874
48	43.96	.840	.828	.800	.882
49	44.90	.841	.829	.804	.889
50	45.79	.841	.831	.809	.894
51	46.62	.841	.834	.815	.896
52	47.39	.841	.836	.822	.896
53	48.11	.841	.836	.829	.894
54	48.80	.840	.834	.835	.890
55	49.51	.840	.830	.841	.883
56	50.26	.840	.823	.845	.874
57	51.07	.839	.815	.847	.863
58	51.96	.838	.809	.847	.850
59	52.92	.836	.805	.845	.836
60	53.92	.833	.805	.840	.821

* Columns (2), (3) and (4) are based on Status of Active Clergy in 1913.

Age of Member (Nearest Birthday) x. (1)	Episcopal Church in United States			Church of Ireland	New York Bank
	Age of Wife (Nearest Birthday) $y(x)$. (2)*	Probability (Based on Salaries) of Having a Wife Living $(h)'x$. (3)*	Probability (Based on Numbers) of Having a Wife Living $(h)x$. (4)*	Probability (Based on Numbers) of Having a Wife Living (Graduated) $(h)x$. (5)	Probability (Based on Numbers) of Having a Wife Living (Graduated) $(h)x$. (6)
61	54.88	.829	.808	.830	.806
62	55.76	.824	.814	.816	.792
63	56.51	.817†	.820	.797	.780
64	57.17	.808	.824	.771	.776
65	57.79	.799	.825	.738	.773
66	58.44	.787	.823		
67	59.21	.774	.819		
68	60.08	.761	.816		

1917 and November, 1921, except six for whom the age was not given made up of one husband with five children aged 3, 5, 6, 7 and 9 respectively, and five bachelors. The omission of these six deaths will not make any material difference in the results which are based upon Table III. The latter table is not presented here with the idea that it will be used for the calculation of the values of family annuities but is shown with the idea of confirming the sufficiency of Table II based on the active clergy.

In order to make a test of the average ages of the wives and the probabilities of having a wife living as given in columns (2) and (3) of Table I a calculation was made of the present value of the expected wives' pensions assuming each wife received an annual pension of $300 for life commencing with the death of the husband. The probabilities in column (3) of Table I were therefore multiplied by the present values of continuous life annuities to the wives whose ages at death of husbands were taken from column (2). The wives' annuities were based on the Danish Survivorship Mortality Table with 4 per cent. interest with adjustment for termination of annuity upon remarriage of the widow. The products thus produced were then multiplied by the total numbers of clergy dying at each age as shown in Table III.

† If these figures are used in actual practice it is recommended that the values in column (4) for ages 63 to 68 inclusive be substituted for those in column (3).

TABLE II.

BASED ON FAMILY STATUS OF ACTIVE CLERGY IN 1913 IN THE PROTESTANT EPISCOPAL CHURCH IN U. S.

Age of Clergyman.	Number of Clergymen Living (B. H. & W.*).	Total Children, Ages 0 to 20.	Number of Children by Age (Nearest Birthday).																				
			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
23	5	0																					
24	8	1		1																			
25	10	4		2		2																	
26	40	5	3	2																			
27	46	13	4	2	4	2	1																
28	50	8	4	1	2	1																	
29	75	26	5	10	5	2	2	1	1														
30	79	29	3	9	3	7	2	3	0	1	0	1											
31	99	55	12	11	8	9	5	6	3	1													
32	99	55	10	14	8	6	5	5	2	3	0	0	1	1									
33	103	69	6	13	12	8	10	7	6	4	2	1											
34	106	101	10	18	13	17	10	15	8	5	1	1	2	0	1								
35	110	104	9	18	13	12	10	12	9	8	6	2	2	2	1								
36	91	94	3	7	9	7	13	10	10	11	8	6	5	3	0	2							
37	123	136	8	12	14	15	13	12	12	11	11	8	9	4	5	1	1						
38	113	168	10	11	14	23	10	17	16	13	9	10	13	11	3	5	2	0	1				
39	116	153	5	8	12	17	13	13	17	13	11	14	5	8	5	5	2	3	0	1	1		
40	120	162	9	8	13	6	13	9	12	11	18	15	13	8	11	6	5	5					
41	118	203	6	7	11	19	18	17	15	22	15	19	15	5	10	12	3	4	1	1	1	0	2
42	135	223	5	14	16	10	16	14	22	15	13	16	21	12	10	11	7	9	3	6	3		
43	117	192	9	5	8	12	11	11	9	20	12	18	16	13	12	11	6	9	4	4	1	1	
44	134	229	5	6	9	8	9	13	15	13	12	21	18	14	15	14	13	12	10	8	5	7	2
45	129	188	3	8	5	9	3	8	9	12	11	14	5	13	10	14	11	15	16	9	6	2	5
46	131	212	0	5	10	7	5	14	6	12	9	15	15	11	14	20	17	17	9	10	10	2	4
47	127	229	0	7	6	10	12	7	12	14	9	18	11	12	14	15	11	13	19	8	16	6	9

TABLE II (Continued)

Age of Clergyman.	Number of Clergymen Living (B. H. & W.*).	†Total Children, Ages 0 to 20.	Number of Children by Age (Nearest Birthday).																			
			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
48	131	229	1	2	3	3	5	10	7	5	16	9	10	19	11	19	20	17	18	14	15	12	13
49	106	171	0	3	0	2	0	5	8	6	9	7	9	7	11	14	8	15	11	18	13	15	10
50	97	138	1	1	2	2	2	5	1	5	11	6	6	5	6	13	16	9	12	12	5	11	7
51	104	146	1	2	1	2	5	3	3	4	3	7	5	7	6	10	14	14	8	13	12	13	13
52	88	98	1	1	3	2	2	2	4	4	1	2	0	8	5	5	11	4	10	6	9	9	9
53	91	140	0	3	2	1	2	2	3	5	5	3	9	5	9	9	11	8	17	8	11	13	14
54	85	97	0	0	2	2	2	0	4	2	1	1	4	4	2	8	8	9	10	9	11	11	7
55	96	100	0	0	0	3	1	2	5	3	0	4	6	7	2	10	5	9	9	7	9	7	11
56	87	74	0	0	1	1	0	1	1	1	2	2	4	3	3	3	3	6	11	5	10	9	8
57	77	68	0	0	2	2	4	2	3	2	0	7	1	4	1	4	1	3	8	5	10	4	5
58	69	38	0	0	0	0	0	0	1	2	2	0	1	1	1	2	4	1	3	2	4	9	5
59	75	46	0	0	0	0	1	0	0	0	1	0	1	2	2	3	2	3	5	6	5	5	10
60	63	37	0	0	0	0	0	0	0	1	0	0	0	0	3	0	3	3	4	6	3	8	6
61	62	37	0	0	0	1	1	0	0	1	0	0	1	1	2	2	4	1	7	2	8	1	5
62	68	35	0	0	0	1	2	0	0	2	0	2	0	1	1	1	2	4	4	3	5	2	5
63	51	16	0	0	0	0	0	1	0	0	0	0	0	0	2	2	2	2	1	1	1	2	2
64	51	18	0	1	0	0	1	1	0	0	0	0	0	2	2	0	0	0	3	1	4	2	1
65	61	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	2	3	2	3
66	44	8	1	0	0	0	0	0	0	0	2	0	0	0	0	1	0	0	0	1	0	2	1
67	34	15	0	0	0	0	0	0	0	0	0	0	0	0	3	0	2	2	0	3	1	1	3
68	30	4	0	1	0	0	0	0	0	0	1	0	0	1	0	1	0	0	0	0	0	0	0
	3,854	4,187																					

* B = Bachelor, H = Husband and W = Widower.

The aggregate number of wives expected to be surviving for all clergymen dying under age 68 was 180.2 whereas the actual number of wives surviving as shown under "H," Table III, including one with clergyman's age unknown, was 172. The ratio of the actual number to expected was therefore 95.4 per cent. Similarly the present value of expected wives' pensions amounted to $730,978 whereas the present value of the actual pensions incurred based on the actual surviving wives' ages was $675,017. The ratio of actual to expected was therefore 92.3 per cent.

Before giving the comparison between actual and expected widows' pensions for clergy dying at or above age 68, an explanation will be given of a device employed in the original calculations on account of the fact that the probabilities of being married and the average ages of the wives were not available in columns (2) and (3) of Table I for ages of the clergy over 68.

Suppose, under a certain pension fund, one of the benefits to be provided for is a life annuity of one unit per annum to the widow after the death of the husband and suppose values of $(h)_r$ up to age 68 are known, that $C_r = v^{r+1} l_r q_r$ and that $\{\frac{1}{2} + \bar{a}_{y(r+1)}\}$ represents the present value of one half unit payable at the end of the year of the husband's death together with an annuity of one unit per annum to a female now age y where y is the wife's age corresponding to a husband's age $(r + 1)$. The present value of this widow's benefit per man now living (whether bachelor, husband or widower) would equal

$$\frac{1}{D_x}\left[\sum_{r}^{67} C_r(h)_{r+\frac{1}{2}}\{\tfrac{1}{2} + \bar{a}_{y(r+1)}\} + \sum_{68}^{\omega} C_r(h)_{r+\frac{1}{2}}\{\tfrac{1}{2} + \bar{a}_{y(r+1)}\}\right]$$

but the values of $(h)_{r+\frac{1}{2}}$ are not known for ages above 68. We may, however, by a simple device obtain an approximate value of the second term of this expression by assuming

$$\sum_{68}^{\omega} C_r(h)_{r+\frac{1}{2}}\{\tfrac{1}{2} + \bar{a}_{y(r+1)}\}$$

$$= (h)_{68} \sum_{68}^{\omega} C_r \cdot \tfrac{1}{2}\left\{\frac{l_k(\frac{1}{2} + \bar{a}_{k+\frac{1}{2}})}{l_{y(68)-5}} + \frac{l_{k+10}(\frac{1}{2} + \bar{a}_{k+10\frac{1}{2}})}{l_{y(68)+5}}\right\}$$

TABLE III.

BASED ON FAMILY STATUS OF ALL CLERGYMEN DYING BETWEEN JANUARY, 1917, AND NOVEMBER, 1921, IN THE PROTESTANT EPISCOPAL CHURCH IN U. S.

Age of Clergyman at Death.	Number of Clergy Dying.			Total Number of Children, Ages 0–20.	Number of Children by Age (Nearest Birthday).																			
	B.	H.	W.		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
27	—	1	—	—																				
30	1	1	—	1		1																		
31	1	3	—	3	1	1	1																	
32	1	—	—	—																				
33	3	3	—	6	1	1		1	1	2														
34	1	1	—	—																				
35	3	2	—	2			1		1															
36	0	2	1	3					1			1			1									
37	1	1	—	—																				
38	—	2	—	7		1		2		2			1		1									
39	—	3	—	3		1				1			1											
40	—	1	—	2									1				1							
41	1	1	—	4							1				1	1		1						
42	—	2	1	7							2		1	1		1		1	1					
43	2	3	—	2							1						1							
44	3	5	1	13				1	1	1	2	2	1	2		1		1	1					
45	—	2	—	8				1		1	1	1	1	1						1				1
46	1	4	—	5										1					1		1	1	1	
47	1	3	—	6							2				1			1		1		1		
48	1	3	—	9					1			1	1	1		1				1			2	1
49	—	4	—	2															1			1		
50	—	3	—	6						1		1		1		1		1						1
51	—	4	1	8								1		1						2		1	1	2
52	—	4	2	5					1							1				1		1		

TABLE III—*Continued.*

Age of Clergyman at Death.	Number of Clergy Dying.			Total Number of Children, Ages 0–20.	Number of Children by Age (Nearest Birthday).																				
	B.	H.	W.		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
53	1	9	—	11											1	2		1			2	2		2	1
54	1	8	—	11						1				1	1			1	1	1	2	1	1	1	
55	1	5	—	4																1		2			1
56	—	3	1	1													1								
57	2	6	—	2								1										1			
58	2	9	1	13										1		1			1	1	2	4		1	2
59	—	7	—	1					1																
60	1	10	3	8										1					2	1	2			1	1
61	—	5	1	3									1						1	1					
62	—	6	—	1																				1	
63	1	7	4	3											1				1			1			
64	1	9	—	4											1	1					1		1		
65	—	7	—	2									1											1	
66	—	16	2	3							1		1											1	
67	1	6	3	—																					
68	—	8	2	—																					
69	—	8	—	1																	1				
70	—	5	1	—																					
71	—	6	4	—																					
72	1	5	2	1																					1
73	—	5	3	1																		1			
74	1	6	2	—																					
75	—	4	1	—																					
76	—	5	1	—																					
77	—	5	2	1																				1	

TABLE III—*Continued.*

BASED ON FAMILY STATUS OF ALL CLERGYMEN DYING BETWEEN JANUARY, 1917, AND NOVEMBER, 1921.

Age of Clergyman at Death.	Number of Clergy Dying.			Total Number of Children, Ages 0–20.	Number of Children by Age (Nearest Birthday).																				
	B.	H.	W.		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
78	—	1	1	—																					
79	—	1	2	2															1		1				
80	—	2	1	1																	1				
81	—	1	1	—																					
82	—	2	2	—																					
83	—	1	1	—																					
84	1	1	3	—																					
85	—	—	—	—																					
86	—	—	1	—																					
87	1	1	—	—																					
88	—	1	1	—																					
89	—	—	1	—																					
90	—	—	—	—																					
91	—	—	—	—																					
92	—	—	1	—																					
94	—	—	1	—																					
97	—	—	1	—																					
	35	239	56	176																					

where age $k = (r + \frac{1}{2}) - 68 + \{y\,(68) - 5\}$ and $(h)_r$ has the meaning assigned to it in Table I.

In other words we employ the probability of the man having a living wife at 68 and multiply by the probability of such wife's surviving the husband. On account of the rapid change in the mortality curve at the higher ages we weight the two annuities, one calculated on the assumption that the average relative age of the wife when husband reaches 68 is $y(68) - 5$ and the other on the assumption that the average wife's age is $y(68) + 5$.

In order to test the accuracy of this assumption in so far as possible the values of widows' continuous annuities of $300 a year for ages 55, 56, 57 etc., were multiplied respectively by the probabilities of a wife aged 55 living 0, 1, 2 etc., years. A similar set of products was computed for wives' ages 65, 66, 67 etc., and durations 0, 1, 2, etc., years. The mean values of these products for wives' ages 55 and 65, 56 and 66, etc., were then obtained and multiplied, in order, by the number of clergymen dying at ages 68, 69, etc. The sum of all these mean values was then multiplied by .761, the probability by salaries of a clergyman at age 68 having a living wife. The present value of the aggregate expected pensions calculated in this way amounted to $186,503 whereas the present value of the actual wives' pensions based on actual wives' ages was $198,682, a ratio of actual to expected of 106.5 per cent. If we had multiplied the sum of the mean values referred to by .816 (the probability at age 68 of having a living wife as shown in column (4) of Table I) the expected pensions would have amounted to $199,982 or the ratio of actual to expected would have been 99.4 per cent. If, therefore, column (3) of Table I is used at any time in actual practice it will be advisable to use the values from column (4) for ages 63 to 68 inclusive.

After various trials an extension was made of column (3) of Table I which produces somewhat greater expected than actual pension values for ages 68 and over. In extending column (3) in this way it is assumed that column (4) values for ages 63 to 68 inclusive will be substituted in column (3). The extended probabilities shown below were obtained by multiplying the ratio .816 at age 68 by the mean values of the probabilities of wives 55 and 65 living 1, 2, 3, etc., years. The ratios thus produced were arbitrarily increased slightly.

Age of Clergyman.	Probability of Having a Wife Living.	Age of Clergyman.	Probability of Having a Wife Living.
68	.816	79	.596
69	.810	80	.568
70	.800	81	.538
71	.784	82	.508
72	.764	83	.478
73	.743	84	.447
74	.722	85	.415
75	.699	86	.384
76	.674	87	.353
77	.649	88	.323
78	.623	89 and over	.300

In order to determine how closely results produced by the use of this table would conform with the actual pension claims I multiplied the mean of the annuity values for wives' ages 55 and 65, 56 and 66, etc., in turn, by the above probabilities of being married, and by the numbers of actual clergymen dying at each age, thus producing 71.9 expected widows and $202,708 expected claims. The actual claims amounted to $198,682 for 68 actual widows. The figures given for actual widows include wives, if any, married after clergyman had attained age 68 whereas the device referred to in a preceding paragraph took no account of remarriages. Under the rules of the Fund, however, no pension provision was made for widows whose marriages took place after the husbands had retired for disability or old age.

Tests were also made to determine how closely the expected orphans' annuities computed on the basis of Table II conformed to the actual orphans' annuities incurred on account of the clergy who died between January, 1917 and November, 1921. The orphans' annuity values of column (3) of Table V were multiplied by the numbers of clergymen dying prior to age 68 as shown by Table III, thus giving expected pensions of $139,555 on basis of pension of $100 a year to age 21. The actual present values of incurred pensions were then obtained by multiplying the numbers of children by age, surviving at each father's age of death, from Table III by the present values of temporary annuities based on the children's mortality table shown in Table IV. These actual present values for fathers' ages below 68 amounted to $129,134 on basis of $100 yearly pension. The ratio of actual to expected orphans' pensions was therefore 92.5 per cent.

Under the rules of The Church Pension Fund orphans' annui-

ties amounted to $100 a year to age 7, $200 from 8 to 14 and $300 from 15 to 21. The expected claims for ages of father below 68 amounted to $348,541 on this basis while the actual claims came to $319,956 making the ratio of actual to expected 91.8 per cent.

The rates in Table IV for ages 0, 1, and 2 are taken from Hewat's Table based on Scottish Ministers' Children whereas the rates for other ages are taken from Henderson's Northeastern States Mortality Table based on population and deaths during years 1908 to 1912 inclusive in the Northeastern States and are on the whole more conservative than Hewat's Children's Mortality Table.

TABLE IV.

Age.	q_x.	Age.	q_x.
0	.06193	11	.00235
1	.01569	12	.00236
2	.00944	13	.00244
3	.00811	14	.00258
4	.00604	15	.00278
5	.00469	16	.00306
6	.00380	17	.00340
7	.00320	18	.00378
8	.00280	19	.00417
9	.00255	20	.00451
10	.00241	21	.00478

Summarizing all of the figures above we obtain the following results:

	Actual.	Expected.	Ratio Per Cent. of Actual to Expected
Present value of widows' pensions with respect to clergy dying under 68	$ 675,017	$ 730,978	92.3%
Same for clergy dying at 68 or over	198,682	186,503	106.5%
Present value of orphans' pensions with respect to clergy dying under 68 (1; 2; 3 basis)	319,956	348.541	91.8%
Same for clergy dying 68 or over	7,991	12,583	63.5%
	$1,201,646	$1,278,605	94.0%

In the original calculations the annuity values shown in column (3) of Table V were arbitrarily extended from age 68 to age 88 and these extended values were used in computing the expected claims of $12,583 given above.

TABLE V.

AVERAGE PRESENT VALUE, AT DEATH OF MEMBER, OF ORPHANS' CONTINUOUS ANNUITY OF $1 PER ANNUM TO AGE 21, PER MEMBER DYING WHETHER BACHELOR, HUSBAND OR WIDOWER AT TIME OF DEATH, 3½ PER CENT. INTEREST.

Age of Member. (1).	Episcopal Church in United States		Church of Ireland.	New York Bank.
	Ungraduated. (2).	Graduated. (3).	Graduated. (4).	Graduated. (5).
21		.97		.50
22		1.66		1.60
23		2.14		2.20
24	1.716	2.59		2.45
25	5.344	2.83		2.51
26	1.691	3.19	.38	2.56
27	3.765	3.63	1.07	2.82
28	2.143	4.16	1.60	3.35
29	4.612	4.81	2.16	4.18
30	4.768	5.61	2.76	5.35
31	7.235	6.61	3.42	7.19
32	7.145	7.74	4.30	9.19
33	8.507	8.95	5.33	11.14
34	12.021	10.20	6.54	12.81
35	11.655	11.45	7.86	13.97
36	11.987	12.69	9.19	13.82
37	12.820	13.83	10.41	13.16
38	16.820	14.82	11.55	12.18
39	14.518	15.59	12.62	11.10
40	14.254	16.09	13.57	10.13
41	18.154	16.18	14.39	10.02
42	16.717	15.99	15.01	10.09
43	16.126	15.56	15.41	10.16
44	15.114	14.95	15.59	10.25*
45	12.084	14.13	15.60	10.00
46	13.328	13.23	15.45	8.88
47	14.402	12.31	15.21	7.62
48	12.074	11.37	14.88	6.22
49	10.268	10.45	14.42	4.92
50	9.514	9.68	13.82	3.65
51	8.582	8.97	13.14	3.25
52	6.934	8.32	12.37	3.10
53	9.250	7.70	11.45	3.22
54	6.372	7.08	10.37	3.67
55	6.225	6.43	9.24	4.06

* Owing to the smallness of the data upon which the values in column (5), especially for ages 44 and over, are based they should not be used in actual valuations unless confirmed by some larger experience.

Age of Member. (1).	Episcopal Church in United States		Church of Ireland	New York Bank
	Ungraduated. (2).	Graduated. (3).	Graduated. (4).	Graduated. (5).
56	4.352	5.61	8.13	4.89
57	5.807	4.78	7.17	4.97
58	2.572	3.97	6.35	5.43
59	2.556	3.23	5.62	4.43
60	2.202	2.60	4.97	2.55
61	2.932	2.16	4.38	2.15
62	2.769	1.84	3.86	1.82
63	1.591	1.62	3.42	1.57
64	2.036	1.48	3.07	1.42
65	0.649	1.40	2.79	1.63
66	1.125	1.34	2.54	.88
67	1.907	1.24	2.29	.65
68	1.311	1.03	2.05	
69			1.83	
70			1.64	
71			1.46	
72			1.29	
73			1.12	
74			.97	
75			.83	
76			.59	

In Table V are shown the average present values of orphans' annuities to run to age 21 under the Fund of the Episcopal Church in the United States based on lives active in 1913; under the Church of Ireland Fund based on the experience of those living averaged for 1906, 1911 and 1916; and under the Fund of a large New York bank based on active males living Dec. 31, 1920. The ungraduated values for the Episcopal Church Fund for any age x were obtained by multiplying the present values of continuous temporary annuities by the number of children at each age and dividing by the combined number of bachelors, husbands and widowers at age x. The figures for the Church of Ireland given in column (2) on page 22 of *J. I. A.*, Vol. LII, were multiplied by the probability of being a husband or widower at each age as obtained from pages 17 and 18 in order to transform them after graduation into the form shown above in Table V. This transformation is required on account of Howell's figures, as explained on page 15 of his paper, having been divided by the number of husbands and widowers, while my figures for the Church Pension

Fund and for the New York bank were divided by the total number of men living whether bachelors, husbands or widowers. As regards the Bank, data was not given for children's ages 18, 19 and 20 so that the present values of the temporary annuities according to the Church Pension Fund for these three ages were added to the values for all earlier ages taken from the status of the Bank's own employees. As the temporary annuities run only to age 21 this substitution, which is doubtless on the safe side, will have very little effect on the final figures shown in the last column to the right of Table V.

As mentioned previously each orphan under the plan of the Episcopal Church was to be given a temporary annuity, increasing at ages seven and fourteen, and continued until he or she attained age 21. In a good many pension funds, however, provision is made for paying a certain annuity to the orphans jointly so long as any of them is under the limiting age. This amounts to substantially the same as the guarantee of an annuity certain for the period determined by deducting the age of the youngest child from the limiting age. With the thought that it would be helpful in valuing benefits of this kind I have collated the data with respect to the youngest children of the Episcopal clergy active in 1913 and in Table VI will be found the total number of active clergy at each age corresponding to the numbers of clergy whether bachelors, husbands or widowers as shown also in Table II. The number of youngest children for each group of clergy living at each age is also given and from these two columns may be determined the probability of having at least one child. The average age of the youngest children is shown, from which may be determined the present value of the annuities to age 21, or to any other earlier age by recalculating the average youngest child's age by eliminating the youngest children who may be older than such other limiting age. The use of the average age would give annuity values somewhat too high in the same way that the value of an annuity certain for the expectation of life is greater than the life annuity. To obtain more accurate values the temporary annuities should be multiplied by the number of youngest children at each age and the sum of these products be divided by the total number of men living at each age.

TABLE VI.

BASED ON FAMILY STATUS OF ACTIVE CLERGY IN 1913 IN EPISCOPAL CHURCH IN U. S., INCLUDING YOUNGEST CHILD ONLY IN EACH FAMILY.

Age.	Number of Clergymen Living.	Number of Youngest Children Between Ages 0–20.	Average Age of Youngest Child.	Number of Youngest Children.																				
				0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
23	5																							
24	8	1	1.00		1																			
25	10	2	1.00		2																			
26	40	5	.40	3	2																			
27	46	9	.89	4	2	3																		
28	50	7	.86	4	1	1	1																	
29	75	18	1.11	5	9	3			1															
30	79	18	1.61	3	9	1	3	1	1															
31	99	34	1.24	12	11	6	3	1		1														
32	99	36	1.44	10	14	5	4	1	1		1													
33	103	38	2.24	6	13	4	6	4	2	2		1												
34	106	58	2.24	10	17	8	10	5	3	3	2													
35	110	54	2.31	9	17	10	5	4	3	4		1		1										
36	91	42	3.62	3	7	7	3	9	4	2	3	3	1											
37	123	65	3.68	8	12	13	6	5	7	2	3	1	2	3		1	1	1						
38	113	76	3.67	10	8	10	16	9	7	4	4	1	2	3	1		1							
39	116	63	4.51	5	7	8	14	6	5	3	2	4	2	1	1	1	2	1	1					
40	120	70	5.20	9	6	10	3	6	4	6	3	8	4	3	4	1	1	1	1					
41	118	77	4.68	6	7	11	12	8	7	3	6	5	5	3		1	2		1					
42	135	80	4.79	5	14	14	4	7	2	11	5	3	5	3	1	2	3				1			
43	117	72	5.72	9	5	8	6	7	4	2	7	5	2	6	3	3		2	2				1	
44	134	84	6.62	5	6	8	4	6	10	6	8	3	6	6	3	3	2	1	5	1		1		
45	129	70	7.67	3	7	5	6		2	6	9	4	8		1	4	3	2	5	1	2	1		1

TABLE VI—*Continued.*

Age.	Number of Clergymen Living.	Number of Youngest Children Between Ages 0–20.	Average Age of Youngest Child.	Number of Youngest Children.																		
				0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
46	131	84	8.40		5	8	5	4	7	3	5	7	6	6	4	4	4	3	4	5	3		1	
47	127	87	8.44		7	5	7	7	5	6	4	3	10	4	2	2	6	5	4	4	3	1	2	
48	131	90	10.17	1	2	3	3	5	6	6	3	7	4	5	10	4	6	5	4	6	1	3	4	2
49	106	75	11.37		3		2		3	7	6	6	4	5	2	4	6	2	6	3	4	3	5	4
50	97	61	10.62	1	1	2	2	1	3	1	3	8	3	2	2	5	8	10	1	1	4	2	1	
51	104	61	11.43	1	2	1	2	4	3	2	2	2	3	3	6	1	4	4	4	2	4	3	3	5
52	88	46	11.39	1	1	3	2		2	3	2				5	4	4	7	1	2	1	3	2	3
53	91	56	12.00		3	2	1	1	1		4	1	2	5	3	3	3	5	4	8	2	4	3	1
54	85	48	13.27			2	2			3	2		1	2	3	2	4	3	3	5	6	4	4	2
55	96	45	12.38				3	1	1	3	2		2	3	3	1	6	2	4	3	4	2	4	1
56	87	37	13.86			1	1			1	1	1	2	2	1	1	2	1	5	8	3	3	2	2
57	77	32	11.78			2	2	4	1		1		3		1		2	1		5	3	5		2
58	69	23	14.65							1	2	1			1		2	4	1	2	1	2	4	2
59	75	23	15.52					1						1	1	1	3	1	2	3	2	1	3	4
60	63	22	15.73								1					3		3	2	2	5	1	4	1
61	62	22	14.05				1	1			1			1	1	1	1	4	1	3	1	3	1	2
62	68	19	14.11				1	2					1			1		2	4	1	1	2	1	3
63	51	11	14.27						1							2	1	2	2			1	1	1
64	51	12	11.83		1				1						2	2					1	3	2	
65	61	11	17.55															1	2		2	2	1	3
66	44	7	13.27	1									2								1		2	1
67	34	8	15.25													3		1	1		1			2
68	30	2	4.50		1							1												
	3,854	1,861																						

Part II.

As of December 31, 1920, I made an investigation into the family status of the employees of one of the large New York banks and it seems appropriate to publish the results of this investigation along with those of The Church Pension Fund. Orphans' annuity values have already been given in Table V. In Table IX will be found the family status from which these annuity values were computed. Although the Bank figures are not based on a very large body of data it seems fairly evident that the cost of orphans' annuities is not so great amongst Bank employees as amongst the clergy, this divergency increasing as the age of the employee advances.

As the pension fund of the Bank provided for annuities to the surviving mothers the ages of the mothers were obtained with the results shown in Table VII. The average age of the mothers at birth of the 1114 employees (male and female) for employees of present ages 14 to 42 inclusive was 27.9 years, this difference in age between employee and mother being almost constant for all ages of the employees.

TABLE VII.

Age of Employee.	Average Age of Mother at Birth of Employee.	Age of Employee.	Average Age of Mother at Birth of Employee.
14	27.3 years		
15	27.0		
16	26.4	31	27.4
17	29.1	32	28.5
18	28.0	33	29.2
19	27.7	34	26.6
20	28.5	35	29.9
21	26.1	36	27.1
22	28.3	37	28.0
23	27.4	38	25.4
24	28.4	39	26.3
25	29.1	40	28.7
26	28.3	41	27.2
27	28.3	42	26.4
28	27.8		
29	26.3		Average, 27.9 years
30	28.5		

The probability of the mother being alive at the death of an employee dying at age x may be obtained by finding the probability that a woman aged 28 (27.9 being the average age of mothers

at birth of children) will live x years. A test of the appropriateness of the ratios so produced for all ages may easily be obtained by multiplying the probability for each value of x, of the mother being alive by the number of employees at each respective age. The aggregate number of mothers expected to be alive may then be compared with the actual number of living mothers. Another and perhaps better method would be to take two ages, such as 24 and 32, equidistant from age 28. Multiplying the probability, at each age x of the employee, of a woman 24 surviving x years by the number of employees at each age and also repeating this process for a woman age 32 the products should be totaled, thus giving aggregate mothers expected to be living of "K" and "L" on the assumption of mothers' ages at birth of child being 24 and 32 respectively. If G is the actual number of mothers alive we may readily find r per cent. such that $G = r$ per cent. of K, plus $(100 - r)$ per cent. of L. Each item in the table of probabilities of a woman aged 24 living x years for all values of x may then be multiplied by r per cent. and added to the corresponding survival probabilities for a woman aged 32 after multiplying these latter by $(100 - r)$ per cent. The resulting table may be taken as representing the probabilities of an employee at any age x having a living mother.

Either of the devices just described might be employed where the data supplied for the fund in question is not extensive enough or sufficiently complete to enable the direct calculation of the probabilities desired.

The average age of the wife and the probability by numbers, of having a living wife were determined from the data furnished by the Bank. The average wives' ages are set forth in Table VIII while the probabilities of having a wife living have been included in Table I in order to enable a ready comparison to be made with similar ratios based on the experience of the two Churches.

It is realized that there is not sufficient experience under this Bank plan to enable the calculation of reliable orphans' or widows' annuities, this being especially true with respect to the higher ages of the employees. The bank has grown very rapidly during the past ten years so that a very large proportion of the employees are young lives. However the comparison of the results with the experience of the clergy may be of some value until data based upon a much broader experience is published.

TABLE VIII.

Age of Male Employee x.	Average Age of Wife (Ungraduated) $y(x)$.	Age of Male Employee x.	Average Age of Wife (Ungraduated) $y(x)$.
20	21		
21	20	46	42.0
22	22.5	47	42.2
23	21.8	48	44.8
24	24.0	49	49.5
25	23.9	50	48.6
26	24.4	51	49.3
27	25.6	52	49.2
28	26.5	53	51.0
29	27.6	54	51.3
30	28.6	55	49.5
31	28.7	56	52.0
32	31.0	57	55.0
33	30.5	58	48.0
34	30.8	59	—
35	30.2	60	53.5
36	35.4	61	45
37	32.4	62	55.3
38	34.3	63	59
39	31.8	64	—
40	36.7	65	61.5
41	36.8	66	—
42	37.3	67	—
43	40.3	68	59
44	42.0		
45	42.0		

Under the pension fund of the Bank which was contributory it was compulsory for new employees entering the Bank's service after the establishment of the fund a few years ago to join the fund but it was voluntary on the part of the employees already in service at that time. The Bank, however, furnished me with cards showing the family status of all the employees whether members of the pension fund or not, so that the figures given in this paper should be complete and free from selection on the part of the employee.

With respect to the Episcopal Church the data is also practically free from selection on the part of the clergy as the contributions were to be paid by the parishes and not by the clergy themselves. A few of the parishes did not come into the fund but the percentage of those staying out was very small.

TABLE IX.

BASED ON FAMILY STATUS OF ACTIVE MALE EMPLOYEES AS OF DECEMBER 31, 1920 IN A NEW YORK BANK.

Age of Male Employee.	Number of Employees.			Total Number of Children, Ages 0–17.	Number of Children by Age.															
	B.	H.	W.		0–1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
20	31	1	—																		
21	23	2	—																		
22	15	2	—	1	1																
23	36	5	—	2	2																
24	22	2	—																		
25	29	10	—	9	3	5		1													
26	13	13	—	8	4	1	1	2													
27	19	16	—	12	6	2	1	1	2												
28	14	13	—	9	4	—	1	2	1	—	1										
29	12	10	—	7	2	1	1	1	2												
30	12	12	—	12	5	2	2	3													
31	5	12	—	9	2	1	1	1	—	1	1	1	1								
32	7	5	—	6	—	—	3	—	—	1	1	—	1								
33	1	17	—	21	4	3	2	5	1	2	3	—	1	1							
34	4	16	—	24	5	1	4	3	2	2	3	1	2								
35	3	16	—	20	2	1	4	2	1	4	1	4	—	1							
36	2	11	—	17	—	1	1	2	2	1	1	2	—	—	2	2	2	—	1	—	—
37	0	7	1	11	—	1	4	1	1	1	1	1	—	—	1						
38	0	9	—	13	2	2	—	1	—	1	—	—	—	1	1	—	3				2
39	2	5	—	3	1	—	—	—	1	—	—	—	1	—	—	—					
40	3	10	1	12	1	—	1	—	—	1	1		—	1	1	3	1	1	—	1	
41	5	9	—	13	2	1	—	1	1	1	1	—	1	3	1	—	—	—	1	—	—
42	0	10	—	13	1	1	3	1	1	2	—	1	—	—	1	—	1	—	—	—	1
43	0	8	—	11	—	—	1	—	—	—	—	1	1	1	2	1	—	1	1	1	1
44	1	7	—	4	—	—	1	—	—	1	—	—	—	—	—	—	—	1	—	—	1
45	0	3	—	1	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—
46	1	4	—	8	1	—	—	1	—	1	—	1	—	1	—	1	—	1	1	—	—
47	2	5	1	11	—	—	—	—	2	2	—	—	1	—	1	—	1	3	—	—	1

TABLE IX—*Continued.*

Age of Male Employee.	Number of Employees.			Total Number of Children, Ages 0–17.	Number of Children by Age.															
	B.	H.	W.		0–1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
48	1	6	—	4	—	—	—	—	—	—	—	—	—	—	1	—	—	1	1	1	—
49	2	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
50	—	8	—	6									1	—	—	1	1	—	1	1	1
51	—	4		—																	
52	—	6	1	6						1					1		1	1	1		1
53	1	4	—	1														1			
54	—	8	—	8					1		1			1			1	1		1	2
55	—	2	—!																		
56	—	1	—																		
57	—	1	—																		
58	2	3	—																		
59	0	—	—																		
60		4	—																		
61	—	1	—																		
62	—	3	—																		
		1																			
63	1	0	1																		
64	—		—																		
65		2																			
66	—	—	—																		
67	—	—	—																		
68	1	2	—																		
69	—	—	1																		
	270	298	6	282																	

Legal Notes.

BY

WENDELL M. STRONG.

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Right to Remove Case to Federal Court:—(Terral, Secretary of State of Arkansas, *vs.* Burke Const. Co., Supreme Court of the U. S., 42 Supreme Court Rep. 188.) This is one of the most important decisions in recent years affecting insurance companies. In many states an insurance company, although technically it had the right to remove a case to a federal court when the state was not its home state, was denied that right because it would be penalized by the revocation of its license. In Security Mutual Life Insurance Co., *vs.* Prewitt, the Supreme Court of the United States had held that while an agreement not to remove a case to the federal court exacted from a foreign company as a condition of a license to do business in the state would be unconstitutional and void, a company's license could be revoked if it did remove a case and a statute providing for this was valid. This practically took away from insurance companies the constitutional right to resort to the federal courts since the revocation of the license to do business was a penalty of such magnitude that a company could not afford to incur it.

In the present case the court overruled this earlier case and held that the license of a corporation could not be revoked for such cause.

Extracts from the opinion are:

"The principle established by the more recent decisions of this court is that a state may not, in imposing conditions upon the privilege of a foreign corporation's doing business in the state, exact from it a waiver of the exercise of its constitutional right to resort to the federal courts, or thereafter withdraw the privilege of doing business because of its exercise of such right, whether waived in advance or not. The principle does not depend for its application on the character of the business the corporation does, whether state or interstate, although that has been suggested as a distinction in some cases. It rests on the

ground that the federal Constitution confers upon citizens of one state the right to resort to federal courts in another, that state action, whether legislative or executive, necessarily calculated to curtail the free exercise of the right thus secured is void because the sovereign power of a state in excluding foreign corporations, as in the exercise of all others of its sovereign powers, is subject to the limitations of the supreme fundamental law. It follows that the cases of Doyle *v.* Continental Insurance Co., 94 U. S. 535 and Security Mutual Life Insurance Co. *v.* Prewitt, 202 U. S. 246, must be considered as overruled and that the views of the minority judges in those cases have become the law of this court. The appellant in proposing to comply with the statute in question and revoke the license was about to violate the constitutional right of the appellee. In enjoining him the District Court was right and its decree is affirmed."

Meaning of Expression "Mode of Settlement of Less Value than Face Amount of Policy:"—(Julius *vs.* Metropolitan Life Insurance Co., Supreme Court of Illinois, 132 N. E. Rep. 435.) The policy in question was for $1,000. On the first page, in stating the amount, it stated it as "$1,000 subject to the reduction specified in the attached rider," such rider providing for smaller amounts varying with age until the insured reached 21 years of age. One of the contentions was that this rider attempted to provide a mode of settlement at maturity of less value than the amount insured on the face of the policy, it being claimed that the only amount mentioned on the face of the policy was $1,000.

The court held that the face of the policy included the rider so that the amount provided for in the rider was the amount provided for on the face of the policy. It also went on to explain the meaning of the statute forbidding a mode of settlement of less value than the policy, as follows:

"The object of the statute is to prevent the insurance company from inserting provisions in its policy providing for optional modes of settlement professedly for the benefit of the insured, but which in fact provide modes of settlement of less value than the amount fixed in the insurance contract which the insured or the beneficiary might have paid to him in one sum. In other words, if the insured or the beneficiary elect to have the sum payable under the policy paid by instalments, the total value of the instalments must not be less than the sum specified in the insurance contract as payable at the maturity of the policy."

In some cases courts have given a similar statute a meaning not its real meaning and in consequence it is important to have on record such a clear and complete statement by the Supreme Court of Illinois of the object and meaning of this statute.

FAILURE TO NOTIFY INSURED THAT REQUEST FOR REINSTATEMENT HAD BEEN REJECTED:—(Lechler *vs.* Montana Life Ins. Co. of Helena, Mont. Supreme Court of North Dakota, 186 N. W. Rep. 271.) The insured paid the first premium on the policy in question by note. This note was not paid. At the end of the first year the second year's premium was not paid and the policy lapsed. Shortly thereafter the agent urged the insured to reinstate and an application for reinstatement was made and a note offered for the payment of the premium. The company refused this, communicating the refusal to the agent and returning the note to him. The agent never returned the note to the insured, nor communicated the fact of the declination of the request to the insured.

The court held that the acts of the agent were the acts of the company and that because of the failure to communicate the refusal to the insured it was bound. Two of the judges dissented, one presenting a very strong dissenting opinion.

CONDITIONS IN NOTE GIVEN FOR PREMIUM:—(Keller *vs.* North American Life Ins. Co., Supreme Court of Illinois, 133 N. E. Rep. 726.) The third annual premium was not paid on the policies in question and some time after the lapse the insured made application for reinstatement and paid the premium, one quarter in cash and three quarters by note. Both the note and the receipt given stated how the payment had been made and contained conditions that in case of nonpayment of the note at maturity all benefits which would have been obtained from payment in cash would be forfeited. The note was not paid. Some months after the end of the third year the insured died and claim was made on the theory that the cash paid and the note given together paid premiums to the end of the third policy year and in consequence extended insurance was in force at the death of the insured. One of the grounds on which this was contended was that the conditions contained in the receipt and the note were not effective because of a state statute, like that in many

other states, which provided that the policy and the application should constitute the entire contract.

In the lower court, judgment was obtained against the company. This was reversed in the Supreme Court which held that the policies were not in force. The following are extracts from the opinion:

"It is true, as suggested by appellant, that courts are prone to construe life insurance policies favorably to the insured, but we are aware of no case in which the court has gone to the length of making a contract by judicial construction which the insured did not see fit or was not able to make in his lifetime. That the payment of premiums by the insured is a condition precedent to or at least concurrent with the assuming of any obligation by an insurance company under terms as are embodied in the policies before us seems beyond question."

"The statute referred to, among other things, provides that no insurance company 'shall make any contract of insurance or agreement as to such contract other than is plainly expressed in the policy issued thereon.' This clause evidently is not applicable to the facts of this case. It relates to the time the policy was issued. If it had the effect, as contended by counsel, that the note was void, and likewise its provisions, because it was not attached to the policy, the appellant could not get any benefit from the execution of the note."

KNOWLEDGE OF AGENT OF MISREPRESENTATION IN APPLICATION:—(American Cent. Life Ins. Co. *vs.* First National Bank of Enterprise, Supreme Court of Alabama, 90 So. Rep. 294.) The question considered by the Supreme Court in this case was whether the fact that the insured had disclosed the true facts to the agent as to matters which were falsely stated in the application estopped the company from contesting. The attitude of the court is shown in the following extract from the opinion:

"The courts have always been anxious to take care of the rights of the assured when the applicant has relied upon the agent informing the company of what has been truthfully told to him about the character of the risk; but the courts never have said that the company is bound by statements contained in an application, when not only the agent, but the assured, knows they are untrue and calculated to deceive, and the application is to be forwarded to the company as the basis of its action."

MISREPRESENTATION IN APPLICATION: KNOWLEDGE IMPUTED TO INSURED WHEN POLICY RETURNED WITH COPY OF APPLICATION

ATTACHED:—(Layton *vs.* N. Y. Life Ins. Co., District Court of Appeal, Cal., 202 Pacific Rep. 958.) The insured died about six months after the issuance of the policy. The claim was contested on the ground of misrepresentation in the application as to previous sickness and physicians consulted. There was testimony that the insured at the time of the medical examination had made truthful statements to the examiner but the examiner entered wrong answers in the application. It also appeared that the examiner had knowledge of the applicant's sickness and consultation of physicians.

The court reversed the decision of the lower court against the company on the grounds shown in the following extracts from the opinion:

"Layton over his own signature declared that he had carefully read each and all of the answers given to the medical examiner, that each was written as made by him, and that each was full, complete and true. The statement contained in the application thereby became his solemn representations, and of the same binding force upon him as though he had himself written them out in his own handwriting and signed them."

"It needs no citation of authority to support the rule that misrepresentation or concealment of the facts relative to the health of those whose lives are insured are peculiarly fatal to contracts of life insurance, because the companies necessarily rely upon the statements and acts of the insured in making the contracts." . . . "But it has been held in this state that when the insured in good faith makes truthful answers to the questions contained in the application, but his answers, owing to the fraud, mistake or negligence of the agent filling out the application, are incorrectly transcribed, the company is estopped to assert their falsity as a defence to the policy. The acts of the agent, whether he is a general agent with power to issue policies, a soliciting agent, or merely a medical examiner for the company, are in this respect the acts of the company, and he cannot be regarded as the agent of the insured, even though it is so stipulated in the application. Notwithstanding the justice of this rule, it is a statement of only a part of the law of the case, and is subject to the limitation that there must be no complicity on the part of the insured, actual or implied. The element of continued good faith enters into such transactions. The policy of insurance in this case was almost immediately delivered to Layton. It was his duty to read it, and we may assume that he did so. He knew, therefore, that the application and the certificate of the medical examiner, each of which was an integral

part of the policy and the consideration therefor, contained two very material and vital statements that were false. His legal and moral duty was to notify the company of the fraud that had been perpetrated. By his silence he virtually approved of the act of the medical examiner and became responsible for it."

MISREPRESENTATION IN APPLICATION:—(Williams *vs.* Mutual Life Ins. Co. of N. Y., Supreme Court of Montana, 201 Pac. Rep. 320.) Some six months after the policy was issued the insured died of tubercular laryngitis. In answer to questions in the application he had stated that the only physician he had consulted within five years preceding the application was Dr. McMillan for a cold. The undisputed testimony showed that he had received treatments not only from Dr. McMillan but also from another physician and was present at a consultation between those two and a third physician. The facts showed conclusively that the malady was a much more serious one than implied by the term "a cold" and that the insured knew that the physicians who were treating him so considered it. The testimony as to these facts was undisputed. The judgment of the lower court was reversed and the cause remanded with directions to enter judgment in favor of the company. In this action the court held that the misrepresentations were as to material facts affecting the risk and were fraudulent, and that the evidence being uncontradicted there was presented "a question of law for the court and not a question of fact for the jury."

MISSOURI RULE RE MATERIALITY:—(Bultralik *vs.* Metropolitan Life Ins. Co., St. Louis Court of Appeals, Mo., 233 S. W. Rep. 250.) The insured died and the company contested the claim under the policy on the ground of misrepresentation in the application. There is a statute in Missouri providing that a misrepresentation shall not be deemed to be material and to render the policy void unless the matter misrepresented actually contributed to the death of the insured and that whether it so contributed is a question for the jury.

The insured in an application made less than seven weeks before her death stated that she was in sound health and had never suffered from diabetes. One physician had attended her for over a year before her death and testified that the cause of death was diabetes, and that she had been ill with it one year. Another

physician called in before the death of the insured testified that the cause of death was diabetes and that the insured had been ill with it more than one year. The proof of death had also stated that the cause of death was diabetes and that the duration of the last illness was one year.

The claimant did not deny that he signed the proof of death but testified that the agent had filled out the proofs and that he (the claimant) had not told the agent either that the insured had been ill for one year or that death was caused by diabetes.

The jury decided in favor of the claimant and appeal was taken. The only evidence for the purpose of proving that the insured did not have diabetes for a year previous to her death was that the examining physician did not find any evidence of the disease in his examination. The court notwithstanding these facts refused to hold that the verdict was contrary to evidence and affirmed the judgment of the lower court.

It would seem that this was a case where there was no substantial evidence to contradict that of the two physicians.

Due Date of Premium:—(Painter *vs.* Mass. Life Ins. Co., Appellate Court of Indiana, 133 N. E. Rep. 20.) The policy was issued in 1907 and provided for payment of premiums annually "on or before each January 17, subsequent to January 17, 1907." Later premiums were changed to quarterly. The quarterly premium due July 17, 1913, was not paid. The insured died shortly after the end of the 31 days of grace. One of the contentions by the plaintiff in this case was that the policy did not become effective until Feb. 28, 1907, and that therefore the payment of quarterly premiums carried the policy until Aug. 28, 1913, so that it would have been in force at the insured's death. The contract was clear as to the date when the policy began to run and the due dates of the premiums, and that it was forfeited unless the premiums were paid not later than the end of the period of grace following these dates.

The court held that the contract definitely fixed the due dates of the premiums and that there was "nothing for the court to construe."

Due Date of Premium:—(Landrigan *vs.* Missouri State Life Ins. Co., St. Louis Court of Appeals, 234 S. W. Rep. 1042.) The

policy was a level premium policy on a one-year preliminary term form. The insured's age had changed about one month before the application was made so the application was dated back to give the younger age and the policy was given a date of issue corresponding to this date of the application, which was the last day on which it could have been issued at the younger age. After payment of one year's premium the policy lapsed. The insured died shortly after the expiration of the period of grace and at a time when if the policy had been dated the date of issue instead of being dated back to obtain the younger age it would have still been in force. Claim was made for the insurance on the ground that the second year's premium was due one year after the date the policy went into force rather than on the date provided for by the terms of the policy. The provision of the policy as to dates when premium was payable was definite, reading as follows:

"This insurance is granted in consideration of the application herefor, a copy of which is attached hereto and made a part hereof, and of the payment in advance of sixty-eight and 20/100 dollars, being the premium for the first year's insurance under this policy ending on the fourteenth day of August, 1918, which is term insurance. The insurance will be continued thereafter as whole life insurance upon the payment of the annual premium of sixty-eight and 20/100 dollars, on or before the fourteenth day of August, in every year during the continuance of this policy."

The court held that payment of one year's premium carried the insurance to one year from the date of delivery of the policy and that the period of grace thereafter made the policy in force at the death of the insured.

This case is extreme in that it disregards the definite due date of the premium set out by specifying the month and day when due and makes a different contract for the parties than that which they made for themselves. It is an added feature that a very definite advantage appeared in this case to the insured from the dating back, namely, obtaining a lower insurance age and consequently a lower annual premium.

What Constitutes Delivery of Policy:—(Bradley *vs.* New York Life Ins. Co., United States Circuit Court of Appeals, 8th Circuit, 275 Fed. Rep. 657.) The application contained the

provision that insurance should not take effect unless "the first premium is paid and the policy is delivered and received by me during my lifetime and good health." The policy was issued and forwarded to the soliciting agent for delivery. He, however, was delayed by his own sickness for some time from delivering the policy and when he finally went to the town in which the applicant was a resident he found that the applicant had died suddenly. One of the questions involved was whether the receipt of the policy by the soliciting agent without any condition attached was equivalent to delivery to the applicant. The court held that it was not and that in view of the conditions in the application the insurance had not taken effect.

DELIVERY OF POLICY:—(N. Y. Life Ins. Co. *vs.* Mason, Supreme Court of Arkansas, 235 S. W. Rep. 422.) The policy was received from the home office by the local agent on Saturday. The insured was killed the following Monday morning, the policy not having been delivered to him. The claimant contended on two grounds that there had been legal delivery of the policy. The first was that the mailing of the policy to the local agent (a note for the premium having been given)

"constituted a constructive delivery, and put the policy into force without an actual delivery to the insured in person. This would be true if the policy was mailed to Humphries unconditionally for the sole purpose of delivery to the insured, but such is not the effect of the transaction if the policy was mailed to the agent of the insurer for the performance of specified duties in making the delivery of the policy."

The court stated in regard to this:

"There is no evidence to show that the policy was mailed to Humphries unconditionally for the mere purpose of delivery without having any other duties to perform. The printed instructions filed with the interrogatories on plaintiff's demand show that the agent was to receive the policy as the agent of the insurer, to collect the premium, and to see that the insured was in good health before delivery of the policy; otherwise to return it to the insurer."

The second contention was that there was actual delivery on Sunday afternoon in that the agent met the applicant and offered to deliver the policy to him and that the applicant requested the agent to keep it for him. The court held in regard to this that

a contract executed on Sunday was void, so that even if what passed amounted to delivery the contract was not in force because of the delivery occurring on Sunday and not being ratified afterwards.

DELIVERY OF POLICY:—(Glover *vs.* New York Life Ins. Co., Court of Appeals of Georgia, Div. No. 1, 109 S. E. Rep. 546.) The wording of the application was that the insurance should not take effect unless "the first premium is paid and the policy delivered to and received by me during my lifetime and good health." The application was approved and the policy mailed to the general agent and remailed by him to the soliciting agent, who because of a change of address did not receive it for a number of days. He in turn mailed it to the applicant, who had already paid the premium, whom it reached after he had been sick some two weeks with typhoid.

A judgment for the company was reversed on the ground that there was nothing more for the applicant to do, the premium having been paid, so that if it had not been for the delay the policy would have been delivered to him before he was taken ill and would have been valid.

DELIVERY OF POLICY:—(Thompson vs. Travelers Ins. Co. of Hartford, Conn., N. Y. Supreme Court, Appellate Div. 4th Dept., 190 N. Y. Supp. 338.) The agent delivered the policy, together with a receipt for the first premium and a new application to be signed, to a clerk of the insured although informed that the applicant was ill with a bad cold. The clerk procured the signing of the new application and when it was received back the agent asked for a check, and, on learning none had been obtained from the applicant, stated he would call the next day for it. He did not call the next day and no payment had been made when on the day following he met the clerk on the street and stated that he could not accept a check and demanded the policy back. The evening of this last day the insured died. The application had the usual provision that the policy should not take effect unless the first premium was paid while the applicant was in good health, and also the usual provision stating that the agent had no power to alter or waive conditions of the policy or extend time for payment of premium.

The court held that notwithstanding the above-mentioned provisions the agent had power to waive the conditions as to delivery and the payment of the first premium during the good health of the insured, and affirmed the judgment against the company.

INTEREST ON OVERDUE PREMIUM DURING PERIOD OF GRACE:—(Summer *vs.* New York Life Ins. Co., Supreme Court of California, 200 Pac. Rep. 621.) The question involved was whether the policy lapsed by non-payment of premium. One of the defences used by the company was that even if the premium was paid before the end of the period of grace (which was the real fact in dispute) no interest was paid so that in any case the conditions of the contract were not fulfilled since it provided for grace of one month "subject to an interest charge of 5 per cent. per annum."

The court held that while it was clearly intended by the contract that the policy should lapse upon failure to pay premium the same was not true with regard to the payment of the small amount of interest.

EFFECT OF ELECTION TO APPLY DIVIDENDS TOWARD PAYMENT OF PREMIUM:—(Owen *vs.* New York Life Ins. Co., Supreme Court of Mississippi, 89 So. Rep. 770.) The policy provided several dividend options. In the application the insured elected that the dividends should be applied toward payment of premium. The third annual premium was not paid when due nor within the period of grace and shortly after the end of such period the insured died. Just before his death and after the end of the period of grace the insured had directed his law partner to look in his office for the premium notice and make payment of the premium. This was done but the check was not accepted.

The court held that when the election was to apply the dividends toward payment of premium the insured could not know without advice from the company the amount to pay and that without such notice the policy in consequence could not be forfeited. As there was some evidence that no notice of the amount of the dividend had been furnished to the insured the judgment for the company in the lower court was reversed and cause remanded for the question of notice to be submitted to the jury.

INDEBTEDNESS ON ACCOUNT OF POLICY:—(Dewerthern *vs.* Reserve Loan Life Ins. Co., St. Louis Court of Appeals, 234 S. W. Rep. 1048.) The policy was dated back seven years, the insured making a cash payment and executing a loan agreement as consideration for the dating back and for the first year's premium. No more payments were made. Some years later the insured died and on discovery of the policy after his death claim was made that extended insurance was in force. The result turned on the question whether there was an indebtedness on the policy for the amount of the loan agreement since if there were such indebtedness there would have been no extended insurance.

The court held that the debt of which the loan agreement was the evidence was an indebtedness on account of the policy. The judgment of the lower court in favor of the company was affirmed.

WAIVER OF RIGHT TO RESCIND CONTRACT:—(N. Y. Life Ins. Co., *vs.* Adams, Supreme Court of Arkansas, 235 S. W. Rep. 412.) The insured lapsed his policy and some time afterward made application for reinstatement. In the application for reinstatement misrepresentations were made as to previous illnesses and physicians consulted. The reinstatement was completed on October 30 and notice of the misrepresentations in the application for the reinstatement was received by the local agent at Memphis on November 28 and by him communicated to the home office without delay. The insured died on January 12 of the following year. The company had not meanwhile returned the premium or taken any steps to cancel the reinstatement, although some investigation had been made.

The court held that by the company's delay in rescinding the contract it waived its right to contest for the misrepresentations. This decision turns on the question of what is a reasonable length of time in which to make investigation and attempt to rescind. The time which elapsed in this case between the first notice to the local agent and the death of the insured was about six weeks, and this the court held was an unreasonable length of time to delay.

EVIDENCE REQUIRED TO ESTABLISH NON-PAYMENT OF PREMIUM:—(Foster *vs.* Metropolitan Life Ins. Co., St. Louis Court of Appeals, Mo., 233 S. W. Rep. 499.) Quarterly premiums upon

the policy were paid for one year carrying it to Feb. 15, 1917. On June 2, 1917, the insured died and the beneficiary made claim. The company stated that the policy had lapsed through non-payment of premium. Suit was brought and plaintiff made no proof as to payment of premiums but simply introduced the policy. Several witnesses testified for the company that the premium had not been paid and the records showed non-payment of premium. Nevertheless the court held that even though the defendant's evidence that premium was unpaid was uncontradicted it was still a question for the jury, and the jury had the right to believe or disbelieve defendant's evidence. The judgment against the company was affirmed.

Statement of Agent held to Modify Contract:—(Sovereign Camp W. O. W. *vs.* Richardson, Supreme Court of Arkansas, 236 S. W. Rep. 278.) The insured was killed in battle in France. The contract provided for an extra premium for military or naval service outside of the United States. The insured had not paid the extra premium. It was testified that at the time the insured was initiated into the order the deputy manager, whose duties were organizing new camps, reviving old camps, and soliciting new members, told those being initiated that the requirement of additional premium for military service had not been enforced and he did not think it would be necessary to enforce it; "that it would not bother the members then being initiated." The court held that this constituted an estoppel against the company. In the opinion it said

"In all such cases as this, where the agent, having express or apparent authority to take the application and initiate members into the appellant society, makes false representations which induce the member to join the order, and which he otherwise would not have done, then the society, through its agent making such false representation, will not be heard afterwards to controvert their truth."

There was a very strong dissenting opinion by Chief Judge McCulloch in the course of which he said

"The effect of the decision of the majority is to say that a soliciting agent of a mutual benefit society in this state may abrogate one of the by-laws of the society by a statement to a prospective member that a by-law had not, or would not be,

enforced. In other words the effect is to hold that such an agent can do indirectly by a false statement what he has no authority to do directly."

Waiver of Provision of Policy:—(Ryan *vs.* New England Mutual Life Ins. Co., Supreme Court of So. Carolina, 108 S. E. Rep. 182.) This policy provided for an extra premium in case the insured engaged in military or naval service during time of war, or as an alternative the reduction of the amount payable in case such extra premium was not paid and death occurred. The insured wrote the local general agent stating that he had become a member of a training camp and asking what effect this would have on his policy. The general agent replied stating that when the insured received his commission he would have to pay the extra war premium. The insured replied to this, sending a check for the regular premium and stating "I understand from yours of the 25th that until I go abroad there is no extra war premium due on my policy."

No answer was made to this letter. The insured the following August received his commission and in October died in service while in this country. The company offered the reduced amount provided for by the policy but this was refused and suit brought for the full face amount. The Supreme Court affirmed the judgment of the lower court against the company.

There was a strong dissenting opinion of which the essence was that inasmuch as the policy stated the requirement of the extra premium and the general agent had stated it even more clearly in reply to the insured's inquiry, the fact that the insured did not receive any reply to his last letter could not properly create an estoppel against the company.

Power of Agent to Bind Company by Statement as to Future Dividends:—(Manhattan Life Ins. Co., *vs.* Stubbs, Commission of Appeals of Texas, Section B, 234 S. W. Rep. 1099.) The plaintiff in this case refused to pay the second premium on the policy whereupon the local manager wrote him stating:

"It is true that the rates on this policy are high, but you will remember we had some difficulty in getting the company to issue the policy. It is a fifteen-year endowment policy. If the assured is living at the end of fifteen years, the policy is worth

its face value in cash, increased by the dividend additions, which will amount to about $1,200 or $1,300."

At the end of the distribution period a very much smaller amount having been offered by the company a suit was brought for the amount of the dividend in accordance with this letter. The court held that this representation of the manager was the inducement which resulted in keeping the policy in force and the company was bound by the representation as to the amount of the dividend.

This is a very extreme case and it is doubtful if it will be followed in other jurisdictions.

CHANGE OF BENEFICIARY:—(Goodrich *vs.* Grand Lodge of Brotherhood of Railroad Trainmen, et al., Supreme Court of Nebraska, 185 N. W. 404.) The insured desiring to change the beneficiary filled out the proper forms and delivered them to the local secretary of the order. The local secretary forwarded them to the general secretary. In order to complete the change of beneficiary the bylaws required that the general secretary should certify the transfer on the back of the certificate, and stated that the change was not completed until after such certification.

The insured died before the change was so certified on the certificate by the general secretary and the question before the court was whether the change of beneficiary had been effected. The court held that it had been since the insured had done all that he was required to do to effect such change and the order had no option except to make the change.

INTERPRETATION OF MISSOURI NON-FORFEITURE STATUTE:—(Milburn *vs.* Royal Union Mut. Life Ins. Co., Kansas City Court of Appeals, Mo., 234 S. W. Rep. 378.) The insured had died not very long after the lapse of the policy and the question was whether paid-up or extended insurance was in force at the time of his death, the claim being made that under the Missouri statute automatic extended insurance was in force.

The policy provided for several options on lapse and further provided, if no other option were elected, for automatic paid-up insurance. The court held against the company on the basis that this was not in compliance with the statute requiring unconditional nonforfeitable paid-up insurance. It does not seem as

if this decision was justified since the provisions of the policy did grant unconditional paid-up insurance and contained no condition under which the insurance could be forfeited so that although the expression used was "paid-up insurance" the resulting insurance was precisely that required by the Missouri Statute. It is to be hoped the case may be reviewed by the Supreme Court of Missouri.

Is a Policy Containing a Disability Benefit an Accident or Life Policy? :—(Jones *vs.* Prudential Ins. Co., of America, Springfield Court of Appeals, 236 S. W. Rep. 429.) The policy involved was an industrial policy providing for industrial insurance and in addition providing certain disability benefits; also providing that the amount payable if death occurred within the first six months was reduced one half unless such death was caused by accident. The policy lapsed for nonpayment of premium and a little time after the end of the period of grace the insured died, such death being the result of an accident which occurred before the policy had lapsed. It was claimed that in addition to being a life policy the policy was an accident policy, and that consequently because of the fact that the policy was in force on the date on which the insured received his accidental injury the liability would attach on that date and failure to keep up subsequent payments did not relieve the company of its liability to pay in case death resulted.

The court held that the policy was a policy of life insurance and that therefore the nonpayment of the premium resulted in its being out of force at the death of the insured.

Increase of Dues to Establish Reserve:—(Tusant, et al., *vs.* Grand Lodge, A. O. U. W., et al., Supreme Court of Iowa, 186 N. W. Rep. 195.) The society was an assessment society and had attempted to increase the amount of the monthly payments in order to bring them up to a level premium rate. In a previous case the court held that this could not be done because of the character of the society as an assessment society and the contract between it and its members as members of a mutual assessment society.

The assessments had been, prior to 1911, $3.85 a month. The opinion in the previous case had indicated that while assessments could not be raised to establish a reserve the only limit upon the

number of assessments was determined by the number of deaths. The society attempted to meet the situation by keeping the assessments the same but increasing the number to three assessments of $3.85 a month, giving approximately the level premium. An injunction was obtained against increasing the number or amount of the assessments. On appeal to the Supreme Court the decree granting the injunction was upheld on the ground that the society could not indirectly thus raise the premiums to the level premium rate which it could not do directly. It, however, modified the injunction by the proviso that assessments sufficient in number and amount to pay current death losses might be made.

Separation of Members of a Fraternal Association into Different Classes on Different Plans of Insurance:—(Case, et al., *vs.* Supreme Tribe of Ben Hur, Supreme Court of Nebraska, 184 N. W. Rep. 75.) In 1908 the by-laws of the order were amended so that those receiving certificates prior to July 1st of that year were put in Class A, whereas those receiving certificates subsequent to that date were put in Class B, the two classes to be distinct, each to raise its own funds and pay its own losses. The new Class B was to pay adequate rates based on age, whereas Class A remained unchanged, but a Class A member had the privilege of changing to Class B.

The court held that the shutting off of new members from Class A, which operated under the old plan, in effect actually destroyed its working ability, and was an unjust discrimination against its members.

Interpretation of Contract:—(Kascoutas *vs.* Federal Life Ins. Co., Supreme Court of Iowa, 185 N. W. Rep. 125.) The policy in question was an accident policy and contained the following exception: "this policy does not cover disability resulting from intentional injury of the insured inflicted by himself or any other person (assaults for the purpose of robbery or burglary excepted), whether fatal or non-fatal." The insured was shot and killed, the shooting being intentional. The court dwelt upon the doctrine that ambiguity in a policy must operate in favor of the policyholder. It held that the provision in question was ambiguous as it might readily be interpreted to cover

only the payments for disability and that therefore it was inoperative to prevent recovery for death.

ACCIDENTAL MEANS:—(Husbands *vs.* Indiana Travelers Accident Association, Supreme Court of Indiana, 133 N. E. Rep. 130.) The insured, while shaking his furnace, was taken with hemorrhage of the lungs, which caused his death within a few minutes. The contract provided for the benefit claimed only if the insured should "through external, violent and accidental means receive a bodily injury which should, independently of all other causes, result in death. . . ." The claim was that the shaking of this furnace required more strength than an ordinary furnace and that "the wrenching and strain of deceased's body by the violent exertion in shaking the furnace was accidental and unintentional on his part, and was unforeseen and unexpected by him."

The Appellate Court held that injury was caused by accidental means (*T. A. S. A.* XXII, 508.) The Supreme Court reversed this and affirmed the judgment of the lower court in favor of the company. Extracts from the opinion are,

"Such a policy covers only cases where death resulted from bodily injury caused by the 'accidental' application of external violence, and not cases where an accustomed and habitual act, intentionally done in the usual way, produced a rupture of the tissues of vital organs of the body that had become weakened by disease, and thereby caused death."

"The recital in the special finding of the conclusions that the wrenching and straining of his body in shaking the furnace was 'accidental,' and that the rupture of the blood vessel was caused by 'accidental means' must be disregarded, except so far, if at all, as they are supported by the facts found. And the facts found fail to show that the insured slipped or stumbled, or that anything fell upon or against him, or that anything whatever that was unforeseen or not intended happened to him of an 'external violent' nature, or that he met with an accident of any kind, except that his exertion in shaking down the ashes in his furnace ruptured a blood vessel weakened by disease, which he did not intend or expect thereby to rupture. But, even if the result of his exertion in shaking the furnace be deemed an 'accident,' it was not shown to have been caused by 'accidental means.'"

ACCIDENTAL DEATH: SUICIDE:—(Columbian Natl. Life Ins. Co., *vs.* Wood, Court of Appeals of Kentucky, 236 S. W. Rep. 562.)

The policy in question provided indemnity for death through "accidental means (excluding self destruction, or any attempt thereat, whether sane or insane)." The insured shot himself and the company contested the claim on the ground of suicide. In the lower court the instruction to the jury was that they should find for the company unless the jury should believe from the evidence that at the time he shot himself the insured was so insane that he did not know he was taking his life. The jury found against the company. On the appeal the Court of Appeals although reversing on other grounds held that this charge was correct.

Provision for Forfeiture if Body Cremated without Notice:—(Kroner *vs.* Order of United Commercial Travelers of America, Supreme Court of Wisconsin, 184 N. W. Rep. 1037). The policy was an accident policy. The claim was contested, one of the grounds of contest being that the body was cremated without giving the seven days' notice to the society, which was required by the contract. The facts were that the cremation was at the wish of the insured, and that the plaintiff, the insured's wife, did not at the time know of the existence of the beneficiary certificate. The lower court had held (*a*) that it was unreasonable to declare and to enforce a forfeiture of the beneficiary's claims under the insurance certificate on the ground that the body was cremated without first giving notice; (*b*) that the beneficiary was excused from giving such notice; (*c*) that under the facts and circumstances in this case the provision as to cremation in the certificate was inapplicable, null and void. The Supreme Court on appeal was evenly divided which under the rule required affirmance of the judgment.

Burden of Proof under Accident Policy:—(Griffith *vs.* Continental Casualty Co., Supreme Court of Missouri, 235 S. W. Rep. 83.) The death of the insured was caused by either suicide or accident, and among the questions was the question where the burden of proof lay. An instruction requested by the company from the lower court and refused by that court was as follows:

"The court instructs the jury that under the terms of the policy in suit the defendant is only obligated to pay the plaintiff the sum of $1,500 in case of the death of the insured by suicide or self-destruction, and that before the plaintiff can re-

cover a larger sum she must have proven by a preponderance or greater weight of the testimony that the death of the insured, Harry C. Griffith, was due to accidental means, and unless she has so proven the jury will return a verdict for the defendant; and in this connection the court instructs the jury that the death of the insured, if found to be due to suicide or self-destruction, was not death by accidental means within the meaning of the contract of insurance or of this instruction."

The Supreme Court held that this instruction should have been given.

DEATH BY ACCIDENTAL MEANS:—(Richards *vs.* Standard Acc. Ins. Co., Supreme Court of Utah, 200 Pacific Rep. 1071.) The policy insured against death by accidental means. The insured with several others went on foot on a day of intense heat a number of miles from the Colorado River to a mining claim. On the return they were all very much exhausted and the insured died of sunstroke before they again reached the river.

The court held that death by sunstroke was death from accidental means, and consequently affirmed the judgment of the lower court against the company.

Annual Report of Treasurer of The Actuarial Society of America for Year Ending April 30, 1922.

Assets May 1, 1921:		
Cash	$ 792.88	
Investments (at cost)	15,536.78	
Excess of Income over Disbursements	3,020.83	19,350.49
Assets April 30, 1922		
Cash	3,813.71	
Investments	15,536.78	
		19,350.49

Details of Income.

Annual Dues	$2,131.80	
Examination Fees	1,530.00	
Sales of Publications:		
Transactions	1,812.74	
Index to Transactions	5.75	
Medico-Actuarial Reports	851.83	
Actuarial Studies	300.75	
Standard Mortality Ratios	15.50	
Specialized Mortality Investigation	10.00	
Functional Heart Murmur and Intermittent Albuminuria	7.00	
American-Canadian Mortality Investigation	367.50	
Problems and Solutions	381.50	
Proceedings Fourth Congress of Actuaries	10.00	
Hunter's Joint Life Tables	60.00	
Pamphlet	.25	
Advertisements	1,835.50	
Interest and Dividends	719.79	
Binding of Transactions	172.00	10,211.91

Details of Disbursements.

Printing, Binding, etc.:		
Transactions	1,451.00	
Reprints of Papers	106.37	
Annual Pamphlet	205.00	
Actuarial Studies	263.75	
Medico-Actuarial Reports (Binding)	325.00	

EXPENSE			
General		894.45	
Examinations:	Postage, etc. 523.55		
	Fees 215.00	738.55	
Committee on Review		13.00	
Educational Committee Printing, etc. 52.79			
	Advertising 8.68	61.47	
Transactions		100.56	
Meetings:			
General 149.15			
Dinners (Net) 46.90		196.05	
RENT		1,400.00	
SALARY		1,200.00	
FIRE INSURANCE		32.01	
LIBRARY		78.20	
EXCHANGE—LOSS ON FOREIGN REMITTANCES		25.67	
BIENNIAL PRIZE		100.00	7,191.08

Book Reviews and Notices.

United States Life Tables, 1890, 1901, 1910 and 1901–1910. Bureau of the Census, 1921. Pp. 496, qto.

Most of the nations of Europe have for many years published, or been in a position to publish, national life tables based upon their periodical censuses and records of births and deaths. The United States, however, on account of the defective registration system (of which some account is given in *T. A. S. A.*, XVIII, p. 271) has until recently been unable to undertake any such work; and it was not until after the census of 1910 that the Bureau for the first time was in a position to publish any life tables, and then they were necessarily restricted to only a portion of the country. The "United States Life Tables, 1910" which were then published (and of which reviews appear in *T. A. S. A.*, XVIII, p. 181, and Actuarial Study No. 1, p. 26) were based upon the census of 1910 and the deaths of 1909–11 in the original registration area; and a second volume was then stated to be forthcoming, which would give other data and tables, together with a more complete explanation of the methods of construction.

The volume with which this notice deals fulfills that promise most elaborately. In addition to a reproduction of the 1910 tables, further tables—making 74 in all—are given for the original registration states which are based upon the estimated population of 1901 and the deaths of 1900–1902, and for white males, white females, negro males and negro females upon the populations of 1901 and 1910 and the deaths of the intervening period, while for certain selected registration states and cities the 1910 tables are similarly supplemented by others constructed from the 1901 data, and for Massachusetts alone the 1890 census has also been employed. The various characteristics of these tables are well brought out in a number of illustrative questions and answers which deal very completely with the comparative rates of mortality of males and females, urban and rural populations, whites and negroes, etc.; and to these are added comparisons with the life tables of twelve other countries—which are reproduced, with full references, and so form a valuable compendium—and also with the

various tables based upon insured lives. Fifty pages of graphs are also shown; and commutation columns at 3, 3 1/2, 4, 5, and 6 per cent., and P_x and A_x at 3, 3 1/2, and 4 per cent. are derived from the 1910 life table of white males and females in the original registration states.

It will be seen from this that the volume contains an enormous mass of material, which will well repay careful study. Its limitations, however, must not be forgotten; and it may even be well to emphasize the point here, because no prominent mention is made thereof either in the volume itself or in the introductory "letter of transmittal." Thus although, as there stated, these tables "undoubtedly reflect more closely than any others the rates of mortality existing at the present time . . . in the general population of the United States," it is to be remembered that only the original registration states—not even the entire registration area—have contributed their data, and that those original states are all, with the exceptions of Indiana, Michigan, and D. C., in the northeastern portion of the country where the manufacturing populations are most dense. The tables, therefore, reflect the mortality of only a portion of the country, and cannot be considered to represent faithfully the conditions in the "general population" as that phrase is apparently intended to be understood in the above quotation. At the same time, of course, the decision to employ only the data of the original registration states is very sound, for the statistics thereby secured are more homogeneous than those of the entire registration area, and are more reliable; and consequently the effects of the known deficiencies of the registration system have been eliminated as far as possible.

One of the most interesting practical additions which the present volume makes to the original life tables of 1910 is the comparison which is now possible between the mortality rates of 1901 and 1910. This is summarized by the statement that "there seems to have been a general improvement in mortality for all classes for the younger ages, that is, to about age 40 for men and age 50 for women, except for the Negro population; but that above those ages there is no improvement, and in some cases the mortality in 1910 was actually less favorable than it was in 1901."

In view of the fact, however, that the most valuable of these life tables have been in the hands of actuaries since 1916, the

chief interest of the present volume will be found in the very elaborate explanations which are given of the methods of construction. In this section of the work there is a lengthy reproduction, from Vol. II of Czuber's Wahrscheinlichkeitsrechnung, of the mathematical theory of the flow of a population, which is of value to some students, and will be rendered much more accessible by its presentation here in English. The basis of the method is the graphical representation of the progress of a population—undisturbed, however, by migration—by means of "life lines," which start at birth and continue until death or enumeration at a census; and it has the somewhat considerable advantage of maintaining a clear distinction between the different types of statistical aggregates of the living and the dead. The fundamental formulae which are thereby developed, however, may be reached easily by the much simpler methods with which actuarial students are familiar, without the intervention of Green's theorem and double integrals; and the explanation of the theory could be improved by fuller explanations of the analogy which exists between the formulae so developed and those of the life table, and by the employment of a more consistent notation—for example, by keeping the age always at the bottom, the interval of birth always on the left, and the observation period always at the top, so that we should have

$_{t/t+1}D_{x/x+1}$, $_{t/t+1}D^{z/z+1}$, $D^{z/z+1}_{x/x+1}$ with $_{t/t+1}E_{x/x+1}$ and $P^{z/z+1}_{x/x+1}$ in place of $D^{t/t+1}_{x/x+1}$, $D^{t/t+1}_{z/z+1}$, $D^{z/z+1}_{x/x+1}$, $E^{t/t+1}_{x/x+1}$, and $P^{x/x+1}_{z/z+1}$

which are difficult to distinguish when numerals are substituted for x, t, and z. Thus the Type I deaths which, with a year as the unit, may be defined as the deaths in a year of age out of those born in a calendar year, are necessarily distributed over two calendar years; so that, for example—keeping here, for ease of reference, the notation employed in this volume—the deaths $D^{1880/1881}_{25/26}$, being the deaths aged 25–26 out of the $E^{1880/1881}_{0}$ who were born in 1880, are clearly $E^{1880/1881}_{25} - E^{1880/1881}_{26}$ where E represents what is here called the "aggregate of those surviving to the same age" (out of those born in 1880)—this relation merely being analogous to the fundamental $d_x = l_x - l_{x+1}$ of the life table. The Type II deaths are the deaths in a calendar year out of those born in a calendar year, and therefore cover two years of age; so that the deaths $D^{1880/1881}_{1905/1906}$, being the deaths in 1905 out of those born in

1880, will obviously be aged from 24 to 26, and will equal $\int_0^1 E_{24+t}^{1881-t}\,dt - \int_0^1 E_{25+t}^{1881-t}\,dt$, that is, $P_{1905}^{24/25} - P_{1906}^{25/26}$, in which E_{24+t}^{1881-t} denotes those born at exact time $1881-t$ who attain (on Jan. 1, 1905) exact age $24+t$. This very brief statement, which does not seem to require elaboration, has the advantage of bringing out the relation

$$P = \int_0^1 E dt,$$

which is not shown in the volume under review; and the analogy to the life table's

$$\tfrac{1}{2}d_x + \tfrac{1}{2}d_{x+1} = L_x - L_{x+1}$$

is apparent. Finally, the Type III deaths are the deaths in a calendar year which occur in a year of age, and therefore cover two years of birth. Thus the deaths $D_{25/26}^{1905/1906}$ in 1905 in the year of age 25–26 arise from the births of 1879 and 1880; and from the 1879 births the deaths clearly occur between Jan. 1, 1905, and attainment of age 26 in 1905 and therefore number $P_{1905}^{25/26} - E_{26}^{1879/1880}$, while from the 1880 births the deaths aged 25–26 in 1905 occur between attainment of age 25 in 1905 and Jan. 1, 1906 (when they are variously aged from 25 to 26), and therefore number $E_{25}^{1880/1881} - P_{1906}^{25/26}$. Consequently

$$D_{25/26}^{1905/1906} = (P_{1905}^{25/26} - E_{26}^{1879/1880}) + (E_{25}^{1880/1881} - P_{1906}^{25/26}).$$

In the life table, of course, which takes no account of different calendar years, there is no expression corresponding exactly to this—although with l_0 births each calendar year the analogous formula is

$$(L_{25} - l_{26}) + (l_{25} - L_{25}) = d_{25}.$$

The theory thus developed is then aplied to subdivide the deaths —which, in the usual registration systems, are tabulated by calendar years and are therefore of Type III—according to the two years of birth from which they arise, and to calculate, from the number of births thence determined, the rates of mortality under five years of age and also the monthly probabilities of death in the first year.

The full description which is given of the method of graduation includes a valuable comparison of the results of applying the fifth difference osculatory interpolation formula with different age

groups as the basis; and the use of Wittstein's formula—modified, however, by the omission of its first term—is explained, together with the details of the process by which Spencer's 21-term formula was applied to smooth the values at the end of the table which had been arbitrarily selected from the different figures produced by the application of three different processes.

The last section but one of the book is a minutely detailed description of the methods by which the numerical work was performed upon the adding machines—over 100 reproductions of adding-machine tapes being shown, with 45 pages of explanatory matter. It is stated that the intention of this section is to provide those who are interested in life-table construction with the means of producing tables for themselves, without a knowledge of the technical processes involved. This seems to us, however, to be a somewhat dangerous objective. The construction of life tables is certainly not an undertaking which should be contemplated by anyone untrained in the necessary theory. Furthermore, as has been well emphasized in a recent review in *J. I. A.*, LII, p. 394, the indiscriminate production of unimportant life tables can serve no useful purpose, and is to be discouraged; and it is extremely improbable that their construction will be at all necessary in the course of the statistical explorations of those unskilled investigators for whom this section of the book has been compiled.

The entire work, however, will undoubtedly be found by actuaries and properly qualified vital-statisticians to be a valuable addition to the literature of life-table construction; and the technical portions are deserving of careful examination, both for the matter that is in them and also in order to carry out the hope, which is more than once expressed, that the complete descriptions given may enable actuaries and others to "make suggestions for improvement in the construction of future tables."

H. H. W.

Insurance Against Unemployment. Joseph L. Cohen. P. S. King & Son, Ltd. London. 1921. Pp. 536.

The author is frankly in favor of unemployment insurance of a compulsory type subsidized by the state. He gives most of his attention to a consideration of the European systems, the Ghent plan, and the British plan. He does not favor the Ghent plan

because it is not compulsory. He believes that labor and trade unions and friendly societies are going to be unsuccessful because they cannot compel workmen to join these associations and contribute to the funds.

He considers the British plan the most successful of any and favors unemployment exchanges. It is interesting to note that this book was written before the report of the committee appointed to investigate unemployment exchanges in Great Britain and before the British fund became practically bankrupt. Whether the author has changed his mind and would amend certain portions of the book in view of the subsequent events is problematical. At any rate, the course of events in England has been different from that apparently expected by the author.

The last section of the book is devoted to the unemployment situation in the United States. The author believes that the labor unions in this country are not strong enough to meet the unemployment situation and that it will be necessary for the states to pass unemployment insurance legislation.

The author apparently favors a plan under which the workmen shall not be expected to contribute to this state fund, but most of the contribution shall come from the employers. Apparently he would be in sympathy with the bill introduced to the legislature of Massachusetts at the session of 1922.

The book contains a good bibliography and the text of several of the most important unemployment insurance acts.

Elements of Statistics. A. L. Bowley. Charles Scribner's Sons, New York. Fourth Edition, 1920. 2 vols.

This book is prepared in the form of a textbook, and is being used as such. The first volume describes the general method of statistical investigation, that is, the collection of data, tabulation, averages, dispersion and skewness, and interpolation. There is also a chapter on the graphic method as well as one dealing with index numbers.

There is an evident attempt to present the material in as simple a form as possible by analyzing some of the data of the National Census,—population, wages, marriage-rate, etc.,—and illustrating the meaning of statistical terms and methods. Still, the reading is not easy, and the student who would get the full benefit of this work will probably require assistance. A good mathematical

knowledge is required to follow the principles outlined in the chapter on interpolation.

The second volume deals with:

Frequency Groups and Curves,
The Theory of Probability and the Normal Curve of Error,
Application of the Law of Error,
The Theory of Correlation, and
Precision of Measurements of Averages, Moments and Correlation.

The Work of the Stock Exchange. J. Edward Meeker. Ronald Press. New York. 1922.

This book very clearly and painstakingly outlines in detail the development of the Stock Exchange, its operation, government, book-keeping and relationship to American and foreign business. The subject matter of each section is clearly set out in bold face type. The indexes are very complete and an extended bibliography is listed by subjects.

It is a book which the student of the Actuarial Society can read with profit.

The Assessment of Physical Fitness by Correlation of Vital Capacity and Certain Measurements of the Body. Georges Dreyer (in collaboration with George Fulford Hanson). Paul B. Hocker, New York. 1921. Pp. 128.

The aim of this book is to supply a method of assessing physical fitness by means of certain physical measurements of the body. It is claimed that definite relationships exist between weight, length of trunk (*i.e.,* height sitting) and chest circumference and that these have a definite relation to the vital capacity of the lungs which is the criterion of fitness. Twenty-four illustrative tables are given in the book which will be of considerable interest to the medical directors of life insurance companies as well as to actuaries and all interested in medical selection generally.

Graphical Methods. William C. Marshall. The McGraw-Hill Book Co., Inc., New York. 1921. Pp. 253 and 220 diagrams, etc.

This is claimed to be the first book in English to present a thorough treatment of the use and construction of graphs of all

kinds. The advantages of graphical presentation of facts are urged, chiefly for ordinary commercial purposes, and the best methods, mechanical or otherwise, of constructing graphs are explained. The actuary will, however, not find much of special interest to him in this volume which aims at a more popular appeal.

*Die Sterblichkeit in den verschiedenen Versicherungsgruppen und ihre neuzeitliche Anderung.** Dr. Albert Akel. E. S. Mittler & Sohn, Berlin. 1922. Pp. 58.

This is Part 30 (January, 1922) of the publications of the German Central Bureau of Mortality Investigation. It consists of (I) a statement of the methods employed and results obtained in investigating the mortality of the groups dealt with, (II) a comparison of the mortality rates for the period of entry from 1876 to 1885 and the period of entry from 1896 to 1905, and (III) twelve tables and two charts.

The report deals with many diverse subjects including the War and its after effects, self-selection, value of medical selection and mortality by amount insured.

Annual Report of the Post Office Life Insurance Business. Bureau of Post Office Life Insurance, Tokio, Japan. 1922.

This interesting volume gives an account of the history and development of Government Life Insurance in Japan from its inauguration in 1916. The department has had a very rapid growth, the number of policies in force being already well over two millions for a total amount of about 225 million yen. Policies are issued on the basis of monthly premiums of multiples of 10 sen, the range of the amount of policies being from 20 to 250 yen.

Personal interview by an official takes the place of medical examination and the amount payable is restricted if death occurs within two years unless from accident or infectious disease. The premiums are collected by postmen (*i.e.*, mail-carriers) but depositors in the Government Savings bank may have premiums paid by transfer from their accounts. Provision exists for Group Insurance, in which case personal interview of all the lives to be insured is dispensed with.

* Rates of Mortality in certain classifications of policies and recent changes therein.

The volume contains numerous Statistical Tables which furnish a very complete analysis of the business both as regards its composition by plan, amount, sex, occupation, etc., and as regards rates of mortality and lapse together with information as to finances.

Other Recent Publications.

A Century of Banking in New York. Henry Wysham Zanier. G. H. Doran Company, New York. 1922.

American Banking Practice. William H. Kniffin. McGraw-Hill Book Company, New York. 1921. Pp. 390.

Calculus for Beginners. H. S. Jones. Macmillan Company, New York. 1921.

Carnegie Foundation for the Advancement of Teaching. Fifteenth Annual Report of the President and Treasurer. The Foundation. New York. 1920, 1921.

Carnegie Foundation for the Advancement of Teaching. Rules for the Admission of Institutions and for the Granting of Retiring Allowances. The Foundation. 1910, 1913, 1918, 1920. 4 volumes.

Census of England and Wales. Preliminary Report, including Tables of the Population. The Registrar General. Government Printing Office. London. 1921.

Digest on Workmen's Compensation Laws. National Bureau of Casualty and Surety Underwriters. New York. 1921.

Elementary Calculus. W. F. Osgood. The Macmillan Company, New York. 1921. Pp. 14 and 224.

Elements of Calculus. W. S. Franklin and others. Franklin & Charles, Bethlehem, Pa. 1921.

Functions of Money. W. F. Spalding. Pitman & Sons, New York. 1921.

Gregory Interest Book. The R. L. Gregory Company. Kansas City. 1921. (Simple Interest Tables at 18 rates.)

Hidden Liabilities of Property Ownership. J. R. McFee. National Assoc. of Life Underwriters, New York. 1921.

Human Factor in Business (Unemployment Insurance). B. S. Rowntree. Longmans Green & Co., New York. 1921.

International Exchange. E. L. S. Patterson. Alex. Hamilton Institute. 1921.

International Finance and its Reorganization. E. M. Friedman. E. P. Dutton & Co., New York. 1922. Pp. 702.

Investment Analysis. W. E. Lagerquist. The Macmillan Co., New York. 1921.

Laws controlling the Investment of Insurance Funds. Financial Publishing Co., Boston. 1921.

Lengthening Life thru Insurance Health Work. The Metropolitan Life Insurance Co., New York. 1921.

Lombard Street. E. P. Dutton & Co., New York. New Edition. 1921.

Mathematics of Accounting and Finance. S. Walton and H. A. Finney. Ronald Press, New York. 1921.

Medical Examinations for Life Insurance. T. D. Lister. Longmans Green & Co., New York. 1921.

Money and Currency. Joseph F. Johnson. Ginn & Co., New York. 1921.

New York City Teachers Retirement Board. Annual Reports, 1st–4th. The Board. 1917–1920.

Official Statistics. A. L. Bowley. Oxford University Press, London & New York. 1921. Pp. 63.

Origin of Modern Calculating Machines. J. A. V. Turck. The Author, Chicago. 1921.

Outlines of Public Finance. M. H. Hunter. Harper & Bros., New York. 1921.

Primer on Old Age Pensions and Aged Dependency in Pennsylvania. Old Age Pensions Commission. Harrisburg, Pa. 1921.

Problems in Business Finance. E. E. Lincoln. A. W. Shaw Co., Chicago. 1921.

Problems of the Birth Rate. L. Pulteney. Macmillan Co., New York. 1921.

Report of the Special Legislative Investigating Committee of the Teachers' Insurance Retirement Fund. Wisconsin Legislature. 1921.

Selling Life Insurance. John A. Stevenson. Harper Bros. New York. 1922.

Service, Security and Cost under different Systems of Compensation. Albert W. Whitney. National Workmen's Compensation Service Bureau, New York. 1921.

Simple Tables. (Logarithms.) W. S. Franklin and B. McNutt. Franklin and Charles, Bethlehem, Pa. 1921.

Social Insurance. J. E. Johnson. H. W. Wilson Company, New York. 1921.

Sociétés d'assurance sur la vie et Sociétés de Capitalisation. Rapport sur la fonctionnement du contrôle pendant les années 1914–1919. The French Government. Paris. 1921.

Taxation of Corporations and Personal Income in New York. H. M. Powell. Boyd Press, New York. 1921. 2 volumes.

Taxation of Federal, State and Municipal Bonds. J. H. Hoffman and D. M. Wood. Bond Buyer Co., New York. 1921.

Tax Exempt and Taxable Securities. S. Spring. Financial Publishing Co., Boston, 1920.

The Census and some of its Uses. G. T. Bisset-Smith. W. Green & Son, Ltd., Edinburgh. 1921. Pp. 14 and 228.

The Health of the Industrial Worker. Dr. E. L. Collis and Dr. Major Greenwood. J. & A. Churchill, London. 1921. Pp. 414 and 450.

The Ultimate in Compensation. (Employers' Liability.) Winthrop Waite. Privately Printed. Waite Stewart Co., New York. 1921. Pp. 26, diags.

Treatise on the Integral Calculus. J. Edwards. The Macmillan Co., New York. New Edition. 1921.

Universal Bond Values Tables. The Financial Publishing Co., Boston. 1921. Pp. 548.

(Dividend rate from 3 per cent. to 8 per cent. payable semi-annually; yield from 2.90 per cent. to 10 per cent.)

Waste in Industry. The Committee on Elimination of Waste in Industry. McGraw-Hill Co., New York. 1921. Pp. 409. (Contains section on health of industrial workers.)

Workmen's Compensation. W. R. Schneider. G. I. Jones Co., Chicago. 1921. 2 volumes.

Obituary.

James McIntosh Craig.

Born April 5, 1848. Died January 20, 1922.

Charles Grant Reiter.

Born July 5, 1861. Died July 30, 1921.

(For biographical note on Mr. Craig see President's address, page 14 of this number and on Mr. Reiter see page 281.)

CHARLES GRANT REITER.

Charles Grant Reiter, a member of the Actuarial Society for over twenty-seven years, died on July 30, 1921, at Cape Elizabeth, Maine, where he had gone a few weeks before from his home in East Orange, N. J., in the hope of improved health.

Mr. Reiter was born in Newport, Pennsylvania, July 5, 1861. He entered the service of the Metropolitan Life Insurance Company when about twenty years of age, and served the company for a little over forty years. For more than twenty-five years preceding his death he had been Assistant Actuary. He was elected to membership in the Actuarial Society on April 26th, 1894, and was a charter member of the Casualty Actuarial Society.

While Mr. Reiter's duties brought him in contact with Ordinary as well as Industrial insurance, it was in the Industrial branch that his most notable work was done. The system of actuarial cards and records now in use in the Metropolitan Life covering over twenty-two millions of Industrial policies in force was developed mainly under Mr. Reiter's supervision.

Mr. Reiter's rather delicate health in the later years of his life, along with his retiring disposition, prevented active participation in the affairs of the Actuarial Society, aside from occasional attendance at its meetings. His close associates, however, will join in a tribute to his ability and fine personal qualities.

Abstract from the Minutes of the Annual Meeting of the Actuarial Society of America, Held in New York, on Thursday and Friday, May 18 and 19, 1922.

Hotel Astor, New York City.
May 18, 1922.

FIRST DAY.

The meeting was called to order by the President, William A. Hutcheson, at 10:45 o'clock A. M.

The following were present:

FELLOWS.

Alsop,	Flynn,	Mabon,
Bagley,	Gaylord,	Marshall, E. W.,
Barber,	Gerhard,	Mead,
Bassford,	Graham,	Milligan,
Birkenshaw,	Hall, S. S.,	Moir,
Bissell,	Hallman,	Morris,
Blackadar, W. L.,	Henderson,	Mowbray,
Blehl,	Hezlett,	Murphy,
Bowerman,	Hoskins,	Papps,
Breiby,	Howe,	Parker,
Brown,	Howell,	Perrin,
Buchanan,	Hunter, A.,	Pettegrew,
Cameron,	Hunter, R. G.,	Rhodes,
Cammack,	Hurd,	Rice,
Cann,	Hutcheson,	Riley,
Carpenter,	Jackson,	Roche,
Craig,	Joffe,	Rose,
Cushman,	Johnson,	Rutherford,
Dark,	Johnston, F. H.,	Rydgren,
Davis,	Kattell,	St. John,
Dawson,	Kilgour,	Salter,
Dow,	King, E. C.,	Scott,
Elston,	Koeppe,	Sheppard,
Fackler, D. P.,	Laird,	Smith,
Fackler, E. B.,	Larus,	Speers,
Fassel,	Linton,	Stephenson,
Fitzgerald,	Little,	Stilwell,
Flanigan,	McConney,	Strong,

TARBELL,	TORREY,	WOLFENDEN,
TEBBETTS,	WALKER,	WOOD, A. B.,
THOMAS,	WATSON, A. D.,	WOOD, W. A. P.,
THOMPSON,	WILLIAMSON,	WOODWARD, G. B.,
		YOUNG.

ASSOCIATES.

ANGELL,	GOULD.	MOULTON,
BEERS,	GRAHAM,	PEIRCE,
BENJAMIN,	HALLIDAY,	REICHGOTT,
BLISS,	HILL,	RYAN,
BROWN,	HOMANS,	SHEPHERD,
BULKLEY,	HUGHES,	SMITH, C. G.,
BUTTOLPH,	JORDAN,	SMITH, V. R.,
CAMERON,	KEYS,	STANLEY,
CREUSS,	LARKIN,	STRONG,
DAVENPORT,	LITHGOW,	TRIMBLE,
DAVIS,	LUNDGREN,	WASHBURNE, A. C.,
DICKENSON,	MACKENZIE,	WHEELER, R. P.,
EVANS,	MILLER,	WHEELER, R. A.

The President, William A. Hutcheson, read his presidential address, and also a tribute to Mr. James McIntosh Craig, whose death occurred during the year.

The minutes of the semi-annual meeting held in Cincinnati on October 27 and 28, 1921, were approved as printed in the Transactions.

The Secretary reported that at the meeting of the Council:

The examination dates for the current year were changed from the 24th and 25th of May to the 25th and 26th of May, because May 24th was Empire Day in Canada, and also that an arrangement had been made whereby officers were given the power to determine dates for 1923, the only year in the near future in which a similar conflict would occur, that would avoid Empire Day in that year.

A resolution had been adopted that each president elected hereafter shall annually appoint one or more Fellows of the Society to assist the Editor of the Transactions in such matters as the editor may desire, the appointment of such assistant editors not to thereby make them officers of the Society or members of the Council.

The report of the Treasurer was read and approved.

The Society proceeded to the election of officers and members of the Council, the following being elected:

President	Robert Henderson
Vice-President	Wendell M. Strong
Vice-President	Arthur B. Wood
Secretary	John S. Thompson
Treasurer	David G. Alsop
Editor of Transactions	John M. Laird
Members of the Council (to serve three years)	James F. Little James B. McKechnie Edward B. Morris
(to serve two years, during the unexpired term of Mr. Laird)	James E. Flanigan
(to serve one year, during the unexpired term of Mr. A. B. Wood)	Percy C. H. Papps

The Society proceeded to the reading and discussion of papers and adjourned at 5:30 P. M. to assemble for dinner at 7 P. M.

SECOND DAY.

Friday, May 19, 1922.

The meeting was called to order by the President, William A. Hutcheson, at 9:45 A. M.

The discussion of papers was continued. This was followed by an informal discussion of the following topics of current interest:

I. *Policy Contracts.*

(1) Is there any active demand for short term endowments or other policies of the "thrift" type and would there be any advantages to life companies from entering into such business on a monthly premium basis? In what respects, if at all, could such contracts be made to differ from a company's usual forms?

II. *Mortality.*

(2) What has been the general trend of mortality in 1922 and what causes appear to have contributed to this result?

(3) What is likely to be a company's experience as to mortality under policies taken out for business purposes? Has any investigation been made by any company along this line?

III. *Terminations.*

(4) How do the termination rates for 1921 and 1920 compare, with particular reference to the first two policy years?

IV. *Total Disability Benefits.*

(5) What is the best basis for calculating the necessary premium (additional to the premium for Total and Permanent Disability benefits) to provide that (i) disability income shall commence and (ii) premiums shall be waived, if the insured is totally disabled and has been continuously disabled for, say, three months, even though the disablement is of an apparently temporary nature and one from which the insured is likely to recover?

(6) What are the legal limitations to the issuance of life policies with temporary disability benefits?

(7) What special steps, if any, should be taken to insure the termination of a monthly disability income, in event of recovery within the policy year, especially where total disability for some specified period, such as three months, entitles the insured to disability benefits? Should this be taken into account in calculation of premium?

(8) Under what circumstances and with what restrictions, if any, should the Total and Permanent Disability provision be issued in connection with business insurance?

V. *Group and "Wholesale" Insurance.*

(9) What underwriting safeguards are necessary in dealing with "wholesale" insurance (the issuance of individual policies without medical examination or with only perfunctory examination to a group of lives to which the legal definition of "group life insurance" is not applicable)? What are likely to be the effects of this type of business upon life insurance business as a whole?

(10) Are there any special provisions which should be inserted into a Group Life contract if it is to be issued on a contributory basis?

VI. *Gain and Loss Exhibit.*

(11) Does any company by its accounting system or otherwise, bring together the cash surrender value paid for a policy and the reserve released by such surrender, with a view to eliminating any large error in either cash paid or reserve?

VII. *Interest.*

(12) What is the probable trend of the interest rate (i) in the near future and (ii) during, say, the next twenty years?

VIII. *Pension Funds.*

(13) What are the functions of an actuary in giving advice about pension schemes?

Mr. Rhodes made the following motion: "Papers accepted for discussion shall not be presented at meetings of the Society unless they shall have been in the hands of members for at least six weeks. The Council may make such exceptions to this rule as it may deem advisable." After some discussion, on motion of Mr. Moir, action was deferred until the Fall meeting.

Examinations of the Society

Held on May 25 and 26, 1922

Examination Committee

OLIVER W. PERRIN.....Chairman
ARTHUR COBURN
EDMUND E. CAMMACK } .....Vice-Chairmen

W. LLOYD BLACKADAR, MURAT L. JOHNSON,
JOHN J. COOPER, JOHN M. LAIRD,
JAMES S. ELSTON, JAMES F. LITTLE,
SOLOMON A. JOFFE, J. BERTRAM MABON,
EDWARD W. MARSHALL.

EXAMINATION FOR ADMISSION AS ASSOCIATE

PART I

1. (*a*) Find the value of

$$5\tfrac{1}{4} - \frac{4.\dot{9}\dot{0}}{.\dot{5}\dot{2} \times 2.\dot{0}76923\dot{5}} \times \frac{1\frac{7}{8}}{4\frac{1}{5}} + 2\tfrac{5}{17\frac{1}{2}} \div 9\tfrac{1}{3}.$$

(*b*) Five men do $.600\dot{6}$ of a piece of work in 2.12 hours. How long will it take 6 boys to finish it, it being known that 3 men and 7 boys working together have done a similar piece of work in 3 hours?

2. A man's income in excess of $2900 and not greater than $5000 is subject to income-tax at the rate of 4 per cent., and the portion in excess of $5000 is subject to 6 per cent. tax. If his salary is $3000 per annum, what will be the effect on his net income if he sells his only investment, $50,000 par value government tax-exempt $4\frac{1}{4}$ per cent. securities at $96\frac{1}{2}$, buys 250 shares of 7 per cent. foreign stock at $82\frac{1}{2}$ and uses the balance as far as possible to buy speculative 9 per cent. foreign stock at $114\frac{3}{8}$, depositing the remainder in a bank at 4 per cent.? Brokerage $\frac{1}{8}$ per cent. on each transaction. Income from new investments is taxable.

3. (*a*) If p is rational and $\sqrt{q}$ a surd number, state and prove under what conditions the square root of $(p + \sqrt{q})$ can be expressed as the sum of the square roots of two rational numbers.

(*b*) Find the value of

$$\frac{1}{\sqrt{12 - \sqrt{140}}} - \frac{1}{\sqrt{8 - \sqrt{60}}} - \frac{2}{\sqrt{10 + \sqrt{84}}}.$$

4. Solve the equations:

(*a*) $x^2 - 2\sqrt{x^2 + 4x - 5} = 13 - 4x.$

(*b*) $x^2 + y^2 - 3 = 3xy.$

$2x^2 - 6 + y^2 = 0.$

(*c*) $\frac{1}{x^3} + \frac{1}{y^3} = \frac{243}{8}.$

$\frac{1}{x} + \frac{1}{y} = \frac{9}{2}.$

5. (*a*) A crew can row a certain course upstream in $8\frac{4}{7}$ minutes and if there were no current they could row it in 7 minutes less than it now takes to drift downstream. How long would it take them to row the course downstream?

(*b*) A merchant bought a number of yards of cloth for \$100; he kept 5 yards, sold the rest at \$2 a yard more than he gave and received \$20 more than he originally spent. How many yards did he buy?

6. (*a*) If $\frac{bz - cy}{b - c} = \frac{cx - az}{c - a}$ and c be not zero, show that each equals $\frac{ay - bx}{a - b}$ and $a(y - z) + b(z - x) + c(x - y) = 0.$

(*b*) Find the square root of

$$9a^{-4} - 18a^{-3}\sqrt{b} + \frac{15b}{a^2} - 6\sqrt{\frac{b^3}{a^2}} + b^2.$$

7. (*a*) Find the condition that the roots of the equation $ax^2 + bx + c = 0$ may be (1) real, (2) equal, (3) imaginary.

(*b*) If x_1 and x_2 are the roots of $ax^2 + bx + c = 0$, find the equation whose roots are $b + ax_1$ and $b + ax_2$.

8. (*a*) If a be the arithmetic mean between b and c, and b the geometric mean between a and c, show that c is the harmonic mean between a and b.

(*b*) If the sum of an arithmetical progression be the same for p terms as for q, show that the sum for $p + q$ terms is zero.

9. (*a*) Find the number of combinations of n things taken r at a time if of the n things p are alike and the rest all different.

(*b*) In how many ways can 10 oranges be given to 5 boys so that each boy gets at least 1 orange? What would be the answer without this restriction?

10. (*a*) Prove by induction the binomial theorem for a positive integral index.

(*b*) Show that

$$1^2 + ({}_nC_1)^2 + ({}_nC_2)^2 + \cdots + ({}_nC_n)^2 = \frac{\lfloor 2n}{\lfloor n \, \lfloor n}.$$

(*c*) Find the term independent of x in

$$\left\{\frac{x^4}{2} - \frac{2}{x^3}\right\}^7.$$

11. (*a*) Show that two triangles are similar when their homologous sides are proportional.

(*b*) Show that the angle between the bisector of an angle of a triangle and the bisector of the exterior angle at another vertex is equal to one half of the third angle of the triangle.

12. (*a*) Find all values of θ in terms of α that satisfy the equation $\cos^2\theta = \cos^2\alpha$.

(*b*) Given $\tan 2x = 3\tan x$, find x.

13. (*a*) Show that

$$\tan^{-1}\frac{a-b}{1+ab} + \tan^{-1}\frac{b-c}{1+bc} + \tan^{-1}\frac{c-a}{1+ca} = 0.$$

(*b*) Show that $\tan\frac{x}{2} + 2\sin^2\frac{x}{2}\cdot\cot x = \sin x$.

14. (*a*) Show that every equation of the first degree represents a straight line.

(*b*) The angular points of a triangle are (1, 2), (4, 3), (3, 6); find the equations of the lines bisecting the interior angles of the triangle.

15. (*a*) Find the equation of the tangents to the circle $x^2 + y^2 = 65$ at the points of intersection of the circle with the straight line $3x + y = 25$.

(*b*) A line moves so that the sum of the perpendiculars to it from the points $(a, 0)$ and $(-a, 0)$ is constant; show that the line always touches a fixed circle.

16. The trial balance of the X.Y.Z. Realty Company at December 31, 1921, shows the following balances:

Sales, 500 lots at average price of $310.00 each	$155,000
Capital Stock:	
Nominal, 10,000 shares at $100 each,	
Subscribed and fully-paid, 6000 shares	600,000
Bonds 5 per cent. due 1940, Cr.	500,000
Commissions paid	15,500
Real Estate at December 31, 1920, 2370 lots at $140.00 each	331,800
Accounts receivable	90,000
Accounts payable	3,200
Salaries	18,000
Office expenses	17,400
Law costs	1,400
Cash on hand	1,500
Cash in bank	42,000
Audit Fee	500
Profit and Loss Account, Dec. 31, 1920, Cr.	27,500
Good-will	500,000
Investments	208,100
Dividends paid	36,000
Interest received	1,500
Interest paid	25,000

Prepare Operating Account, Profit and Loss Account and Balance Sheet, assuming all lots of equal value.

PART II

1. (*a*) Prove by mathematical induction that

$$\frac{1}{1\cdot 2}+\frac{1}{2\cdot 3}+\frac{1}{3\cdot 4}+\cdots \text{ to } n \text{ terms} = \frac{n}{n+1}.$$

(*b*) If $c_0, c_1 \cdots$ are the coefficients in the expansion of $(1+x)^n$ show that

$$\frac{c_0}{1}+\frac{c_1}{2}+\frac{c_2}{3}+\cdots+\frac{c_n}{n+1}=\frac{2^{n+1}-1}{n+1}.$$

2. (*a*) Give the first five terms of the expansion of $(1+x)^{-\frac{1}{2}}$ in their simplest form and hence show that $\sqrt{\frac{2}{3}}$ may be obtained

in the form of the series

$$1 - \frac{1}{4} + \frac{3}{32} - \frac{5}{128} + \frac{35}{2048} - \cdots.$$

(*b*) Show that the coefficient of x^r in the expansion of $(1 - 4x)^{-\frac{1}{2}}$ is

$$\frac{\lfloor 2r}{(\lfloor r)^2}.$$

3. (*a*) If of $p + q + r$ things p be alike of one kind, q alike of another kind and the rest different, find the total number of combinations by taking some or all of the things.

(*b*) In the number of permutations of n things r together, find the number of permutations in which p particular things occur.

4. (*a*) Define logarithm, characteristic, mantissa. Given the logarithms of all numbers to base a show how you would calculate the logarithms to base b.

(*b*) Solve the equations:

$$2^{x+y} = 6^y, \qquad 3^x = 3 \cdot 2^{y+1}.$$

5. (*a*) Prove that

$$\frac{1}{4}\left(e^2 - e^{-2}\right) = \left(1 + \frac{1}{\lfloor 2} + \frac{1}{\lfloor 4} + \frac{1}{\lfloor 6} \cdots\right)\left(\frac{1}{\lfloor 1} + \frac{1}{\lfloor 3} + \frac{1}{\lfloor 5} + \frac{1}{\lfloor 7} + \cdots\right).$$

(*b*) If α and β be the roots of the equation

$$x^2 - px + q = 0$$

show that

$$\log_e (1 + px + qx^2) = (\alpha + \beta)x - \frac{\alpha^2 + \beta^2}{2}x^2 + \cdots.$$

6. (*a*) Explain three tests for convergency or divergency of infinite series.

(*b*) Test for convergency the infinite series

$$1 + \frac{2x}{\lfloor 2} + \frac{3^2x^2}{\lfloor 3} + \frac{4^3x^3}{\lfloor 4} + \frac{5^4x^4}{\lfloor 5} + \cdots.$$

7. (*a*) Sum to n terms the series

$$\frac{3}{1 \cdot 2} \cdot \frac{1}{2} + \frac{4}{2 \cdot 3} \cdot \frac{1}{2^2} + \frac{5}{3 \cdot 4} \cdot \frac{1}{2^3} + \frac{6}{4 \cdot 5} \cdot \frac{1}{2^4} + \cdots.$$

(*b*) Sum to infinity the series

$$\frac{1}{8\cdot 18}+\frac{1}{10\cdot 21}+\frac{1}{12\cdot 24}+\frac{1}{14\cdot 27}+\cdots.$$

8. (*a*) Of three independent events, the odds are 2 to 1 against the first and second both happening, 3 to 2 against the second and third and 9 to 1 against the first and third. Find the odds against all three happening.

(*b*) There are 5 dollars and 4 quarters placed at random in a line; show that the chance of the extreme coins being both quarters is $\frac{1}{6}$. Generalize the result in the case of m dollars and n quarters.

9. (*a*) The probability of the happening of an event in one trial being known, deduce the formula for the probability of its happening at least r times in n trials.

(*b*) On the average there is one death in a certain city from an automobile accident three days out of every four; find the chance that there will be no deaths on at least five out of six specified days.

10. (*a*) There are 9 coins in a bag, 5 of which are dollars and the rest unknown coins of equal value; find what they must be if the probable value of a draw is 60 cents.

(*b*) Two persons throw alternately with a single die and he who throws first an ace is to receive a prize of $10. What are their respective expectations?

11. (*a*) An observed event has happened through some one of a number of mutually exclusive causes; deduce the general formula for the probability of any assigned cause being the true one.

(*b*) A purse contains four coins; two having been drawn and found to be dollars, find the chance that all are dollars.

12. (*a*) If δu_0, $\delta^2 u_0 \cdots$ be differences of $u_0, u_{\frac{1}{2}}, u_{\frac{2}{2}} \cdots$ and Δu_0, $\Delta^2 u_0 \cdots$ be differences of $u_0, u_1, u_2 \cdots$, find by the method of separation of symbols the values of δu_0, $\delta^2 u_0$, $\delta^3 u_0$ in terms of Δu_0, $\Delta^2 u_0$, $\Delta^3 u_0$, assuming third differences constant.

(*b*) Find u_2, having given:

$u_0 = 98203$ $\quad u_1 = 97843$ $\quad u_3 = 97034$ $\quad u_4 = 96569.$

13. (*a*) Show that Lubbock's summation formula taken as far as third differences is identical with Woolhouse's taken as far as third differential coefficients.

(*b*) By the method of finite differences find the sum to n terms of the series, $1 + 6 + 15 + 28 + \cdots$.

14. (*a*) Find $\frac{dy}{dx}$, having given (1) $y = x^{\sin x}$ and

$$(2)\ y = \log \frac{\sqrt{1 + x^2} - x}{\sqrt{1 + x^2} + x}.$$

(*b*) Find $\frac{d^n y}{dx^n}$ when $y = x^2 a^x$.

15. (*a*) Find the total derivative $\frac{du}{dx}$ and express the answer in terms of x, having given $u = z^2 + y^3 + zy$, $z = \sin x$ and $y = e^x$.

(*b*) Using Maclaurin's theorem find the expansion of $\sin^2 x$ in terms of x and its powers.

16. (*a*) Evaluate (1) $\int \frac{dx}{e^{2x} - 2e^x}$, (2) $\int (\log x)^2 dx$.

(*b*) Find the area bounded by the curve $y^3 = x^2$, the axis of x and the ordinate $x = 4$.

PART III

1. (*a*) Express δ and d each in terms of i, and δ in terms of d.

(*b*) Amounts of $S_1, S_2, S_3, \cdots S_r$ are due in $n_1, n_2, n_3, \cdots n_r$ years. It is decided to commute these payments to a single payment equal to their sum payable in n years at an agreed rate of interest. Show that

$$n = \frac{n_1 S_1 + n_2 S_2 + \cdots + n_r S_r}{S_1 + S_2 + \cdots + S_r} \text{ approximately.}$$

Show whether this approximate formula favors the debtor or creditor.

2. A payment of \$100 is to be made every four months for ten years, the first payment four months hence.

Calculate the approximate present value of this annuity at four per cent. per annum compounded quarterly, given $a_{\overline{40}|}$ at 1 per cent. = 32.8347.

State an exact formula for the value, and indicate a convenient practical method.

3. A corporation purchased on November 1, 1921, a 6 per cent. semi-annual bond of \$10,000 maturing May 1, 1933. It was purchased to yield 5 per cent. nominal convertible semi-annually. The corporation carries its book values on the amortization plan. Given $a_{\overline{23}|}$ at $2\frac{1}{2}$ per cent. = 17.3321:

(*a*) What are the amortized values for the statements of December 31, 1921, June 30, 1922, and December 31, 1922?

(*b*) What entries will appear in the Interest and Bond Ledger Accounts in connection with this bond for the year ending December 31, 1922?

4. A corporation has given a series of 6 per cent. notes for $10,000 each, payable respectively on June 1st of each year from 1926 to 1931, inclusive. It plans to provide funds to meet these notes by making five annual deposits in a sinking fund which will presumably earn interest at 4 per cent. The first deposit is to be made June 1, 1922. Given $s_{\overline{5}|}^{-1}$ at 4 per cent. = .184627:

(*a*) What should be the amount of the annual deposit?

(*b*) Indicate without calculating what the fund should amount to on June 1, 1926, after paying the note due on that date.

5. (*a*) By referring to a mortality table, how would you determine at what age it is most probable a person aged x will die?

(*b*) In one year in a stationary population there were 1,683 deaths among 59,683 persons living between ages x and $x + 1$. Calculate the value of q_x.

(*c*) Show how $\mathring{e}_x$ may be expressed in terms of L_x, L_{x+1}, L_{x+2}, etc.

6. (*a*) Give an expression for the probability that of two lives (x) and (y) one at least will live 10 years but both will die within 15 years.

(*b*) Given ${}_{15}p_{25} = .79$ for females and .82 for males, calculate how many of 1000 couples married at age 25 will have been broken by death in 15 years. How many widows will then be living?

7. Write expressions for the probabilities that:

(*a*) (y) will be alive t years after the death of (x);

(*b*) (y) will be alive at the end of the tth year after the year in which (x) dies.

8. Two formulas for $a_{y\urcorner x}$ are as follows:

(*a*) $\Sigma v^t \cdot {}_tp_x(1 - {}_tp_y)$ and (*b*) $\Sigma v^t \cdot {}_{t-1}|q_y \times {}_tp_x(1 + a_{x+t})$.

Give the corresponding formulas for $a_{\overline{yz}|x}$ and prove their identity.

9. (*a*) Express A_x in terms of P_x and d and give a verbal interpretation.

(*b*) Prove algebraically that

$$P_{x\,\overline{t}|}^{(m)} = \frac{P_{x\,\overline{t}|}}{1 - \dfrac{m-1}{2m}\,(P_{x\,\overline{t}|}^{1} + d)}$$

and give a verbal explanation of this formula.

10. (*a*) Express $P_{x\overline{n}|}$, ${}_nP_x$, $P_{x\overline{n}}^{\frac{1}{}}$, and a_{x+n} in terms of commutation symbols and prove that the difference between the first two may be expressed in terms of the last two. Give a verbal interpretation of the result.

(*b*) On the assumption that money yields no interest, what would be the formulas for $A^1_{x\overline{n}|}$, $P_{x\overline{n}|}$, and $(IA)_x$?

11. (*a*) Express A^1_{xy} in terms of Joint Life Assurances and Joint Life Annuities and prove your formula.

(*b*) A parent age 35 purchases a Pure Endowment for $1000 on the life of his son aged 2, payable on attainment of age 21.

The policy is purchased by annual premiums payable for nineteen years while both father and son are alive.

In the event of the death of the father while the son is alive, the policy provides an additional benefit of a temporary life annuity to the son of $20 a month, with the first payment on the first of the policy month succeeding the death of the father and the last payment one month before the maturity of the Endowment.

In the event of the death of the son during the lifetime of the father and before maturity of the policy, all premiums paid are returned.

Express in commutation symbols the gross premium, assuming that the net premium is loaded with a constant and a percentage.

12. (*a*) Distinguish between $a^{(m)}_{y|x}$, $\mathring{a}^{(m)}_{y|x}$, and $\hat{\mathring{a}}^{(m)}_{y|x}$.

(*b*) Express A^2_{xyz} and $A^1_{x\overline{yz}}$ in terms of assurances depending upon the first death.

13. The effect of an occupational mortality is to change the probability of surviving a year in a fixed ratio for all ages below 60. After age 60 is attained, the mortality is normal.

Obtain an expression for the net extra premium ceasing at age 60 upon a whole life policy issued at age x.

14. A deferred annuity of $100 per annum upon a life now aged 35, to be entered upon at age 59, is to be purchased by 25 annual premiums. The annuity is to be complete and with return of the excess of premiums paid over annuity payments received upon death of the annuitant occurring after the annuity has been entered upon. On the assumption that death occurs in the middle of the year, obtain an expression for the net annual premium (neglecting loading) and explain how you would arrive at a solution.

15. (*a*) Given a table of temporary annuities, show how you

would construct a table of single premiums for Endowment Assurances. How would you check your work? Adapt your method so that a continuous process may be employed.

(*b*) What results are obtained if we enter single and annual premium conversion tables, respectively, with the following functions:

$$a_{\overline{n-1}|}, \quad a_{x\overline{y^{n-1}}}, \quad a_{\overline{xy}^{n-1}|}?$$

16. A club in a stationary condition has 5000 members. Annual fees are payable in advance from all members below age 65. New members are admitted at age 35 and are charged an entrance fee sufficient to cover the annual fees of the non-contributors. Give expressions for (*a*) the number of contributors and non-contributors, (*b*) the entrance fee, (*c*) the average age at death of the contributors, and (*d*) the average age at death of the present non-contributing members.

PART IV

1. (*a*) Express d_x as a definite integral, and also as a derivative.

(*b*) Derive the approximate relation

$$q_x = \frac{2\mu_{x+\frac{1}{2}}}{2 + \mu_{x+\frac{1}{2}}}.$$

(*c*) Show how you would calculate an approximate value for $\mu_{[x]}$.

2. (*a*) Differentiate $\bar{A}_x$ with respect to x.

(*b*) Differentiate $\bar{a}_x$ with respect to x and hence show that if a certain combination of interest and mortality produces values of ${}^{\alpha}\bar{P}_x$ which are always $2\mu_x$ then $\bar{a}_x = kl_x$ where k is a constant.

3. (*a*) Express as a definite integral the value of an assurance payable at the death of (x) provided he die second of three lives (x), (y), and (z), (y) having died first. What modification will be necessary if an additional condition is that (y) must die before attained age 50?

(*b*) Express as a definite integral and develop a convenient method of calculating the value of an assurance payable on the death of the survivor of (x) and (y) if (z) be then alive.

4. Assuming Makeham's first law of mortality, prove that

$$\bar{A}^{1}_{xy} = \frac{1}{1 + c^{y-x}}\,\bar{A}_{xy} + \frac{1 - c^{y-x}}{1 + c^{y-x}} \cdot \log s \cdot \bar{a}_{xy}.$$

5. Develop the relation

$$a_x^{(m)} = a_x + \frac{m-1}{2m} - \frac{m^2-1}{12m^2}(\mu_x + \delta)$$

by means of Woolhouse's Formula

$$\Sigma^{(m)}u = \int_0^\omega u_x dx + \frac{1}{2m}(u_0 + u_\omega) - \frac{1}{12m^2}\left(\frac{du_0}{dx} - \frac{du_\omega}{dx}\right) + \frac{1}{720m^4}\left(\frac{d^3u_0}{dx^3} - \frac{d^3u_\omega}{dx^3}\right) \cdots .$$

6. A life annuitant, now aged 55, drawing \$100 per annum, payable in semi-annual instalments, desires to draw quarterly instalments in future, with a proportional payment at death. If the change is made on the 3 per cent. net basis, and a semi-annual payment has just been made, what will be the reduced amount of annuity? Given $\bar{a}_{55} = 12.568$, $\mu_{55} = .02077$, $\delta = .02956$.

7. (*a*) Write expressions for the nth year terminal reserve on a whole life policy issued at age x in terms of the following: (i) annual premiums and rate of discount, (ii) annual premiums and annuity, and (iii) single premiums.

(*b*) Deduce algebraically and also by general reasoning that

$${}_nV_x = \frac{P_x - P^1_{\overline{xn}|}}{P^1_{\overline{xn}|}}.$$

8. A pure endowment policy was issued at age x to mature in $n + t$ years with full return of gross premiums in event of prior death. Assuming that the loading is a percentage of the net premium plus a constant, write expressions for the nth year terminal reserve according to the retrospective and prospective methods and prove them equal.

9. (*a*) What effect is produced upon ${}^{\infty}\overline{P}_x$ and ${}^{\infty}_{n}\overline{V}_x$ if we assume that Gompertz's hypothesis for the law of mortality holds?

(*b*) Outline a continuous method for the construction of a complete table of terminal reserves for annual premium endowment assurances.

10. Show how a comparison of reserves on two different bases of mortality and interest may be made by using a function which assumes equal policy values and which is dependent upon the excess death strain and the excess interest of one basis over

the other. Apply the method to determine what effect an increase or decrease in the rate of mortality by a constant ratio will have upon whole life reserves, the rate of interest being unchanged.

11. A reversionary annuity to (y), first payment at the end of the year of death of (x), is purchased by annual premiums payable during their joint lifetime. Show that the reserve upon the policy during the lifetime of (x) and (y) equals the product of a fixed quantity by the difference in reserves upon two whole life policies, the first upon a joint policy and the second upon the life of (y) alone.

12. Write brief historical notes on the following:

(*a*) Dr. Richard Price and Elizur Wright.

(*b*) The failure of the Albert Life Office and the European Life.

13. (*a*) Discuss briefly the liberality of the modern life insurance policy as contrasted with one of 50 or 60 years ago.

(*b*) Draft a provision for policy loans under a life insurance policy.

14. A policy contains the words "all statements made by the insured shall be deemed representations and not warranties." Explain carefully the distinction here made.

State what facts are material to the issuance of a policy and note briefly what effect a misstatement will have upon the contract.

15. (*a*) Define i_x, $p_x{}^a$, $p_x{}^{ai}$, $q_x{}^i$, and calculate the value of r_x having given that $p_x{}^{ai} = .0007$ and $q_x{}^i = .088$.

(*b*) Prove that

$$a_{\overline{x\,n-1}|}^{\,a(i\bar{n})} = \frac{N_x^{ii} - N_{x+n}^{ii} - D_x^{it} \cdot \mathrm{a}_{\overline{x\,n}|}^{i}}{D_x{}^{aa}}.$$

16. An n year term policy provides that in the event of total and permanent disability before age 60 during the term of the policy, future premiums will be waived and 10 per cent. of the face of the policy will be paid on each succeeding policy anniversary during the lifetime of the assured and his continued disability. Obtain expressions for the net premiums and reserves on active lives for this disability benefit. Show also how to calculate the premiums for a similar benefit with monthly income payments beginning six months after disability.

EXAMINATION FOR ADMISSION AS FELLOW

PART I

1. Describe a practical method by which a company may determine each year approximately at what ages and under what plans of insurance it is experiencing a low or a high rate of mortality as compared with the American Men Select Table or some other standard select table.

2. (*a*) Describe the two usual methods of making a census and state the data required.

(*b*) Describe fully the construction of a population mortality table from census returns and statistics of births and deaths, including the treatment of data for infantile ages.

3. (*a*) State the main advantages and disadvantages of summation methods of graduation. What supplementary processes are necessary under such methods to graduate completely a mortality table? In what cases would you use such a method?

(*b*) Express in a general formula the summation method of graduation and derive therefrom Spencer's twenty-one term formula.

4. Give a brief description of the Manchester Unity Sickness Tables 1893–1897. State your opinion of the reliability of these tables for use in the United States or Canada as a basis for individual disability policies.

5. What information is given by the American-Canadian Mortality Investigation report with regard to:

(*a*) Mortality by plan of insurance,
(*b*) Mortality by place of residence,
(*c*) Mortality among women?

6. A company is planning to write insurances on individual lives within certain limitations without medical examination. What questions would you include in the application blank to enable the medical department to assess the risks? What limits, if any, would you suggest as to plans, entry ages, and amounts of insurance?

7. Describe the various methods which may be used by a company transacting substandard business to provide for extra mortality on substandard risks. Which method do you believe

to be the best from the standpoint of the Agent and the Home Office, and why?

8. State what treatment you would recommend and give your reasons therefor in the following cases:

(*a*) Young applicants showing a very small amount of albumin in repeated specimens,

(*b*) Applicants with functional heart murmurs.

9. How would you calculate additional premiums to provide for the inclusion in life policies of:

(*a*) Monthly income (leaving the amount of insurance unaffected) upon permanent total disability prior to age 60,

(*b*) Additional death benefit should death be due to accident?

Would the additional premium for either benefit be affected by a provision for termination of the accidental death benefit in event of permanent total disability?

10. Describe in detail how you would compute a complete set of non-participating premiums. What difference, if any, would you be disposed to make according to the size of the company—large or small—for which the rates were to be prepared and why?

11. How would you arrange the valuation of annual premium deferred annuities, without return of premium in event of death, supposing such contracts were issued in considerable numbers?

12. (*a*) What mortality tables are generally used and what assumptions enter into the valuation of Industrial policies? (Answer for either United States or Canada.)

(*b*) How would you value policies written at extra premiums where the extra premium was charged for (i) Occupation, (ii) Physical Impairment, (iii) Residence? Would the method of arriving at the extra premium have, usually, any bearing on the valuation?

13. Describe in detail a system by which a large company could value its policies by the age attained method, giving working formulas; and outline the practical processes of such a system. What are the advantages and disadvantages of this form of valuation?

14. Compare the plan of automatic premium loans with that of automatic extended insurance, with particular reference to the high rate of discontinuance experienced in 1921.

15. On a joint ordinary life policy for $10,000 on two partners, issued three years ago, information regarding the following types of changes has been requested:

Change as of original date to

(*a*) Two single life policies for $10,000 each,

(*b*) Two single life policies for $5,000 each,

(*c*) A $10,000 policy on one life only.

State on what basis you would compute figures for each change, and what requirements you would make.

16. How would you treat a request for change from Ordinary Life to Ten-year Term

(*a*) Before a premium has been collected,

(*b*) After one quarterly premium has been collected,

(*c*) After one annual premium has been collected?

What adjustments in commission would be required?

PART II

1. (*a*) A moderate sized company distributes surplus by a three-factor method, using interest, mortality and loading returns. Describe in detail how you would determine the three factors for the dividend formula.

(*b*) How would your calculations be affected by the following facts: (1) the company had an abnormally low mortality experience during the past year, (2) the company's surplus on amortized values is 2% of its policy reserve on the American 3% basis.

2. A well established mutual company which paid no dividends in 1920 adopted an entirely new schedule beginning January 1, 1921. If you had been actuary of that company, what preliminary investigations would you have made and how would you have determined the schedule?

3. (*a*) A company now on the American 3½% reserve basis decides to change to the American 3% valuation basis for both old and new business. Discuss the effect of the change on the dividend scale.

(*b*) Show how you would calculate the net effective interest rate of your company and what modification, if any, you would make in the rate for use in determining the rate of excess interest distribution under (1) full paid policies, (2) instalment certain settlements.

4. (*a*) Outline an office system to obtain the Gain and Loss Exhibit item "Net Premiums of the Year," and state what effect, if any, the payment of quarterly premiums will have on this item and the corresponding loading.

(*b*) Give a consistent method of obtaining "Cost of Insurance" and "Interest to Maintain Reserve," assuming terminal reserves to be released on deaths.

5. A policy contains a provision that in case of permanent total disability future premiums will be waived and the face of the policy itself will thereupon be paid in the form of a monthly income of $5.75 per thousand for 20 years certain and as long thereafter as the disabled insured survives. Upon the death of the disabled insured, the company pays to the beneficiary in one sum the commuted value of the monthly income for the unpaid portion of the 20 years certain. Describe in detail the bookkeeping entries necessary upon approval of the claim, during the period of disability and upon the death of the disabled insured.

6. (*a*) What factors must be considered in determining the suitability of a certain investment for a life insurance company?

(*b*) Discuss the suitability of the following investments for a life insurance company:

Municipal Bonds;
Real Estate Mortgages on City Property;
Foreign Government Bonds;
Bank Stock.

7. State what effect recent conditions have had on (1) public utility bonds, and (2) industrial bonds, respectively, and give reasons. What is the future outlook as to interest earnings and security of principal on each of these two classes of investments?

8. (*a*) Compare the Canadian Banking System with the Federal Reserve System; what are the advantages and disadvantages of each?

(*b*) State fully what influence the Federal Reserve System has had upon financial conditions in the United States during the past five years.

9. (*a*) What is Fiat money? Distinguish between money and capital.

(*b*) Upon what conditions may paper money be issued in either Canada or the United States? (Answer for only one country.)

(*c*) Mention one European country which has recently issued paper money too freely. Outline the more important results of its action.

10. What are the objections, if any, to the following designation of beneficiary:

(*a*) Ralph Roe, Trustee;
(*b*) John Doe, Creditor, as his interest may appear;
(*c*) Monthly instalments to Mary Doe, wife, as long as she lives and does not remarry;
(*d*) John Doe, a minor, without the right to change the beneficiary?

11. (*a*) What are the chief differences between the provisions of the insurance laws of New York State and of the Dominion of Canada?

(*b*) A policyholder was reported drowned six months ago under circumstances free from suspicion. His body, however, has not been found and he has not been heard from since. The beneficiary demands payment of the claim. State what your action would be and give the legal basis for it.

12. A large manufacturing plant which has kept complete and accurate employment records wishes to pension each employee who has completed at least 20 years of service and who because of sickness, injury, or old age is no longer able to work. What method of computing the pension would you recommend? What information would you require in order to estimate the immediate and future cost of a pension plan to the employer? Would you recommend that part of the cost be borne by the individuals? If so, how would you take care of the older men who will probably soon be ready for a pension?

13. You are retained to investigate the adequacy of the rates of a large old fraternal order granting both death and sickness benefits, and to determine whether the order is solvent. Investigation shows that the rates are inadequate and that the order is insolvent on an actuarial basis. What method of dealing with the situation would you recommend, assuming that to raise the rates on the old membership to an adequate basis would disrupt the order?

14. Outline the inception, course and present status of the discussion regarding preliminary term legislation of certain eastern states, mentioning briefly the arguments used by both sides.

15. Discuss the advantages and disadvantages of reinsurance of individual risks from the point of view of:

(*a*) The original company;
(*b*) The reinsuring company.

In your answer distinguish between "Coinsurance" and "Reinsurance on the One Year Renewable Term plan for the net amount at risk."

16. Answer either (*a*) or (*b*) of this question:

(*a*) It has been proposed that your company enter into an agreement with one or more banks to sell life insurance in conjunction with bank deposits. What plan of life insurance is best adapted to such a program? What are the advantages and disadvantages:

(*a*) To the insurance company;
(*b*) To the bank;
(*c*) To the agents;
(*d*) To the public.

(*b*) Discuss the development and present status of Non-Cancellable Accident and Health Insurance in the United States, and outline a report to the Board of Directors on the advisability of your company entering on the Accident and Health Insurance business.

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TRANSACTIONS

OCTOBER 19TH AND 20TH, 1922.

Address by the President, Robert Henderson.

The Logical Basis of the Theory of Probabilities.

In view of the importance of the Theory of Probabilities in actuarial science and of the recently published treatise on that subject by Mr. Keynes, whose radical views on the fundamentals of the theory are of such a nature as to be somewhat startling to an actuary, it has appeared to me that the present is an appropriate time for me to formulate and present a few remarks on the subject of the logical basis of the theory. I wish to say, however, by way of reassurance, that my address will not be devoted to a review of Mr. Keynes's book with a discussion of the points wherein I disagree with his view. The time at our disposal would be altogether too short for such an undertaking. Since his book appeared, however, I have read it carefully and critically more than once and this address is therefore undoubtedly considerably influenced by such reading, both in the subject-matter treated and in the form of expression used. This influence is shown to a certain extent in the modification of views previously held in order to meet objections which appear to be valid but perhaps to a greater extent in the restatement of views in such a manner as to bring out points of view apparently overlooked in criticisms which do not appear to be valid. It is not my purpose, however, to give this address a polemic tone. I shall on the contrary endeavor to develop the subject from my standpoint in as simple and logical a manner as possible and to limit closely the statement and criticism of conflicting views.

No endeavor will be made, at least not at this stage, to give a brief and at the same time definite statement of the essential nature of probability. We have become accustomed to learning a great

deal about subjects of study, such as electricity or light, without being able to say with certainty what their essential nature is. We shall therefore commence by examining the relations of probabilities with other conceptions or phenomena with which they are associated.

In the first place then a probability relates to some specific proposition which has been or might conceivably be asserted and to the question whether or not that proposition is true. In the typical case it will be uncertain whether or not it is true but this uncertainty approaches in the limit in one direction to certainty that the proposition is true and in the other to certainty that it is not true.

The probability is also related to a second proposition either absolutely or hypothetically true. To take for example the simple case of the tossing of a coin the proposition to which the probability primarily relates is that the toss results in a certain way but it also depends upon the second proposition or hypothesis that the toss is made.

For the sake of brevity I propose to call the first proposition in such cases the conclusion and the second the hypothesis and the joint assertion of the truth of the hypothesis and the conclusion will be called the complete conclusion.

In the case which arises frequently in connection with the direct estimation of probabilities the hypothesis and the conclusion are statements about the same subject—which subject may supposedly be changed without changing the probability. For example, take the case already cited, the hypothesis may be stated, "x is an occasion when a coin is tossed" and the conclusion "x is an occasion when head turns up." It is then seen that they are each in the form of a proposition but that the common term is a variable. This brings us to the idea of a propositional function. You are all familiar with the idea of a proposition or statement and also with that of a function. With regard to that of a propositional function I probably cannot do better than quote to you from Professor Keyser's recently published lectures on Mathematical Philosophy. He says:

"The answer, describing rather than strictly defining, is that a propositional function is any statement containing one or more real variables, where, by a real variable, is meant a name or other symbol whose meaning, or value as we say, is undetermined in the statement but to which we can at will assign in any order we

please one or more values, or meanings, now one and now another. I fear that what I have just said is too general to be quite intelligible. The idea can be made sufficiently clear, however, by some simple examples—by concrete definition—provided you will understand that the examples are to the general concept in question as a burning match to a world-conflagration or as a few water drops to a boundless ocean. If we denote the real variables by such symbols as x, y, z, w, etc., then for simple examples of what is meant by propositional function we may cite the following quite at random: x is a man; x is a lover of y; x is the specific gravity of y; x is a noble citizen intemperately desiring to impose abstinence on y; x has been divinely appointed by y to subjugate z; $2x - 3y = 10z + w$; $\sin x = \cos y$; x denied that y said that z confessed to being the author of w; x knows that y voted against z on account of jealousy of w; and so on ad infinitum. How many variables may enter a propositional function? As many as we please. How many such functions are there? Their name is legion—the host of them is literally infinite. Even so, you may wish to say, the examples are not impressive. Nevertheless, the concept they represent, each in its little way, is sovereign—like Jupiter among the Roman gods, first without a second."

Professor Keyser then proceeds to point out the distinction between a proposition and a propositional function but for the purposes of this discussion it is more important to observe that any proposition may be converted into a corresponding propositional function such as "x is a set of circumstances under which the proposition would be true."

A very important property of a proposition or propositional function from the standpoint of probability is its range. We may define the range of a propositional function as the aggregate of all the different values of the variable which will convert it into a true proposition. The range of a proposition, if taken as equivalent to the range of the corresponding propositional function, is thus the aggregate of all the different sets of circumstances under which the proposition would be true. For the purposes of our discussion any two propositions may be considered as equivalent if their ranges coincide because in that case if one of the propositions is true under any given circumstances the other would be true also.

We have seen that a probability is a relation between a given hypothesis and a supposed conclusion. It is not concerned however with those circumstances under which the stated conclusion may be true but the hypothesis is not complied with. In other

words, the conclusion must be taken in its complete form. Looking at it from the standpoint of ranges it is therefore a relation between the range of the hypothesis and that of a compound proposition asserting the truth of both the hypothesis and the stated conclusion. I propose to investigate the consequences of assuming that the probability is of the nature of and subject to the same algebraic transformations as the ratio of the latter to the former in order to see whether those results agree with our conceptions of the properties of a probability.

In the first place then the range of the complete conclusion is included in and forms a part (or possibly all) of the range of the hypothesis so that the two ranges must be considered as of the same sign and the former not greater than the latter. On our assumption therefore a probability will be positive and not greater than unity so that even though we hold that probabilities have not ordinarily a numerical value we recognize that they have this in common with proper fractions that they lie in some sense between the limiting values zero and unity.

In the second place a proposition cannot be both true and not true under the same circumstances. The range, therefore, of a compound proposition both asserting and denying it, though also asserting any proposition or hypothesis whatever, vanishes. The probability, therefore, on any hypothesis that a given proposition is both true and not true under the same circumstances is equal to zero.

In the third place since any set of circumstances included in the range of the complete conclusion must include either the truth or the falsity of any third proposition that range may be considered as the sum of two, one of which is the range of a proposition combining the complete conclusion and such third proposition and the other that of the proposition compounded of the complete conclusion and a denial that the third proposition is true. We conclude therefore that the probability on any given hypothesis that a given proposition is true is equal to the sum of two probabilities, one that the given proposition and any third proposition are both true and the other that the given proposition is true and the third not true. Since this is true for any propositions it applies in the case when the given proposition is equivalent to the hypothesis so that its probability is unity and the rule becomes a statement that on any

given hypothesis the sum of the two probabilities, one that any assigned proposition is true and the other that it is not true, is equal to unity.

This definition and the derived rules may be stated much more briefly if we adopt the convention of designating a proposition and its range by a letter near the beginning of the alphabet such as a or h and the joint assertion of two propositions a and b by writing the two letters together as ab remembering that this does not denote an ordinary algebraic product which does not arise between ranges. Then if we denote the probability of a on the hypothesis h by a/h we have

$$a/h = \frac{ah}{\bar{h}} \qquad \text{Def. (1)}$$

$$0 \leqq a/h \leqq 1 \qquad \text{Rule (1)}$$

$$a\bar{a}/h = 0 \text{ or } a/\bar{a} = 0 \qquad \text{Rule (2)}$$

$$\left.\begin{array}{c}(ab/h + a\bar{b}/h = a/h \\ (a/h + \bar{a}/h = 1\end{array}\right\} \qquad \text{Rule (3)}$$

where the contradictory of a proposition is designated by a bar over the corresponding letters.

These symbols are introduced at this stage in order that the fourth rule which I wish to introduce may be most concisely derived. It is as follows:

$$ab/h = \frac{abh}{h} = \frac{abh}{ah} \cdot \frac{ah}{h} = b/ah \cdot a/h \qquad \text{Rule (4)}$$

or in words the probability on hypothesis h that a and b are both true is equal to the product of the probability that b is true if a and h both are into the probability that a is true if h is. This is the general rule for a compound probability. To these four rules I wish to add a definition which from the last preceding rule can be seen to be capable of expression in various ways. Two propositions, a and b, are said to be independent of one another in h if

$$\begin{array}{l} b/ah = b/h \\ \text{or if } a/bh = a/h \\ \text{or if } ab/h = a/h \times b/h \end{array} \qquad \text{Def. (2)}$$

or, in other words, if the probability of the compound proposition ab is equal to the product of the probabilities of a and b.

These four rules and the definition constitute a set of funda-

mental theorems from which all the results of the mathematical theory of probability may be derived if we remember that the sum of two probabilities represents a probability only if it can be brought under rule (3), and that the product of two probabilities represents a probability only if it can be brought under rule (4) either directly or by definition (2). It may seem a strange statement to make that a complete foundation has been laid for the theory of probability when no rule has yet been provided for assigning definite values to probabilities because none has been provided for measuring ranges and when we have in fact so far reserved the possibility that a probability is not a number in certain cases. Mr. Keynes in fact holds that the great majority of probabilities arising in practical life and the ones of greatest importance are not numbers and by that he does not mean that their numerical value cannot practically be determined but that they in fact have no such value. Without debating, at least at this point, the validity of his views in this respect it is well to note that it has not been found necessary to introduce any principle at variance with them.

It is not my intention to inflict upon you the details of the proof of my claim that the results of the Mathematical Theory of Probability may be deduced from these theorems. They will be incorporated in an appendix printed with this address so that you may study them at leisure and I will here merely touch the high spots indicating the general course of the argument. In one direction it proceeds through a proof of Whitworth's fundamental "axiom" which he states as follows:

"If an event can happen in a number of different ways (of which only one can occur) the probability of its happening at all is the sum of the several probabilities of its happening in the several ways."

Stated in the more general language which I have been using this would be:

"If on a given hypothesis a proposition can be true only in conjunction with some one of a number of other propositions (of which no two can be true in conjunction with one another and with it) the probability on that hypothesis of its being true is the sum of the probabilities of its being true in conjunction with the several other propositions."

From this we deduce the ordinary rule of *a priori* probability as follows:

"If an event can hapen in m ways and fail in n ways, all these ways being equally likely and such that one must, but not more than one can, occur the probability of the event happening is $m/(m+n)$."

Here again if we wish to be general we will substitute the truth of a proposition for the happening of an event.

It is interesting to note that this rule may be derived immediately from our fundamental assumption because if it is possible to analyze the range of the hypothesis of a probability into $m+n$ equal mutually exclusive parts of which m constitute the range of the complete conclusion, then the probability is $m/(m+n)$. This rule gives a definite numerical value for the probability in those cases which come under it, but I think you will agree that we would very much restrict the scope of the theory if we limited it to such cases. The rule assumes that we are able to determine whether or not the probabilities of two mutually exclusive propositions are equal to one another but does not itself give us any criterion for such determination.

On account of its bearing on this particular question another result which may be deduced from the fundamental rules, without the use of the special rule referred to, is worthy of attention. In order to avoid the frequent repetition of a rather involved phrase a new definition is necessary. Suppose that on any given hypothesis there are a number of different conclusions of which at least one must be true and not more than one can be true, and that with each of these conclusions there is connected a definite value of some variable, then the sum of all the probabilities of the respective conclusions each multiplied by the corresponding value of the variable will be called the *expectation* of the variable. It is to be noted that even though the values of the variable may be numerical the expectation is not unless the probabilities are numerical also. If then we have a number of propositions the expectation of the ratio of the number of true propositions to the total number is equal to the average of their probabilities and provided the propositions are independent the expectation of the square of the difference between the actual ratio and the expectation of the ratio is less than $1/n$. But this expectation must be greater than h^2 times the probability that this difference is as great as h. This latter probability must therefore be less than $1/(nh^2)$ and, no matter how small h is, so long as it does not vanish, this probability can be made less than any

assigned quantity by sufficiently increasing n. The actual proportion of true propositions is always a number. The average of a number of independent probabilities tends, therefore, to approach indefinitely close to a number or quantity as the number of propositions is indefinitely increased. If now we suppose that the probabilities in question are all equal to one another the average is constant and equal to each. Each probability must therefore be a number in such a case. It would appear therefore that if a probability is not a number it must be impossible to conceive of an indefinitely great number of independent propositions whose probabilities are equal to it. Where however such a conception is possible the probability is numerically equal to the limit, as the number of propositions is indefinitely increased of the ratio of the number of true propositions to the total number. This result may be used as a rule for the practical approximation to a probability because if we can determine the truth or falsity of a number of independent propositions whose probabilities were equal to the one in question, we may take the ratio of the true propositions to the total as such on approximation of which the expectation, as previously defined, will equal the probability and the precision will increase without limit with the increase of the number of cases observed. It is interesting to observe that this result might have been taken as the definition of the measure of a probability and that from it the four fundamental theorems could have been determined. The probabilities so defined are however all unquestionably numerical and so the definition is not inclusive if we admit the existence of probabilities which are not numerical. In a book published some sixteen years ago I gave a definition practically equivalent to this as follows: "The numerical measure . . . for the probability of an event under given circumstances is the ultimate value as the number of cases is indefinitely increased, of the ratio of the number of times the event happens under those circumstances to the total possible number of times." This definition has been quoted and commented upon in a book recently published in this country and I repeat it now in order to take advantage of the best opportunity I shall probably ever have to point out that the ideas embodied in it are all contained in the definition given by the late Sir George F. Hardy in Vol. 31 of the Journal of the Institute of Actuaries in a review of two papers on Probability by Professor Chrystal and Dr. T. B. Sprague, respectively. His definition is "If the prob-

ability of an event A is p, then in any large number N out of a series of independent cases in which the event A is in question, A will happen on the average on pN occasions, and by taking N sufficiently large the ratio of the number of occasions upon which the event happens to the total number N may be made to differ from p by as small a quantity as we please" and he continues. "We fail to see how any other meaning than this can be attached to the mathematical notion of probability, whether the actual value of p in any given case is estimated from *a priori* considerations or from experience; for, in the former case, if the statement do not hold true, this is a proof that the assigned value of p is erroneous."

It will be noted that this definition is thoroughly objective and that its relation to the state of mind of any person is reduced to a minimum. In contrast we quote the *a priori* rule already deduced putting it in Whitworth's alternative form, which is probably the simplest complete statement of it as follows: "If there be $m+n$ equally probable events one of which must happen and only one can happen, and if any one of m of these events will produce a certain result which cannot otherwise be produced, the probability of this result is $m/(m+n)$." This rule does not assume that probabilities are either objective or subjective. We discover a stronger trend to the subjective side in the rule as stated by Czuber. I quote Mr. Fisher's translation: "If our positive knowledge of the effect of a complex of causes is such that we may assume *a priori*, t cases as being equally likely to occur, but of which only f $(f<t)$ cases are favorable in causing the event E, in which we are interested, then we define the proper fraction $f/t = p$ as the mathematical probability of the happening of the event E."

Here the subjective element is brought in much more strongly and in my opinion this statement places the probabilities so defined in the light of the best possible estimate of the objective probabilities with which we have been hitherto dealing. If we call this the subjective probability we see that it is, of course, affected by our knowledge of the operating causes and of probabilities which appear to us analogous. From this point of view it would follow that the same necessary relations and rules of combination would hold for subjective as for objective probabilities because those relations should be included among the facts upon which the estimates are based.

It may in fact happen that our only substantial basis for estimating a probability is a necessary relation of greater than or less than some other probability.

Finally we have a thoroughgoing subjective view in Mr. Keynes' definition as follows: "A *definition* of probability is not possible unless it contents us to define degrees of probability-relation by reference to degrees of rational belief." We would probably all agree with this if the order of emphasis were changed and would concur in a statement that the degree of belief in a proposition which it is rational to entertain increases or decreases with the subjective probability as above defined. The definition itself is however a peculiarly barren one so far as the derivation of relations between probabilities is concerned. This is illustrated by the fact that its author finds it necessary to assume as axioms a great many theorems, some of them complicated, which could be deduced from the common definitions of the textbooks and which may accordingly be deduced from the fundamental assumption of this discussion.

We have thus three contrasting views of probabilities. The first is purely objective and thus offers the best basis for theoretical discussion and the determination of the necessary relations between the probabilities of related propositions. It is however impossible in practice to determine such probabilities exactly and we are consequently forced to use the best possible approximation. From the nature of the case such approximations should have the same necessary relations among themselves as the ideal but practically undeterminable objective relations. There are two main ways in which these estimates are in practice made with satisfactory precision. One is the *a priori* rule sometimes made the basis of the mathematical theory and already quoted in Czuber's form. The other is the observation of a large number of cases judged to be of equal probability and it depends on the theorem already mentioned that the probability of material error is small if the number is fairly large. These practical probabilities thus bear much the same relation to the ideal ones as the points and lines marked on a sheet of paper or a blackboard do to the ideal points and lines of geometry. It is well however to point out that each of the two methods just mentioned involves a judgment of the equality of the probabilities, in the one case of mutually exclusive propositions and in the other of independent propositions. For example, take as a concrete case

to which they might either be applied the tossing of a coin. The first method would divide the possible results of the toss into two sets, one giving head and the other tail, and from a consideration of the form of the coin and the conditions of the toss we might come to the conclusion that their probabilities were equal and therefore each equal to one half. The second method would observe the results of tossing the coin a great many times and assuming that the probabilities in the various tosses were equal would use the ratios of the number of heads and tails to the total as estimates of the respective probabilities. The third view is that the real substance of the probability is the degree of belief or expectation which should be entertained, and we have agreed that these degrees of belief should have the same relations of equal, greater or less as exist between the corresponding estimates wherever an estimate is possible.

Which of these points of view is preferred will probably depend largely on personal idiosyncrasies, but on either view it would seem to be satisfactorily established that the relations are controlled by the four fundamental theorems which were derived from a consideration of the relation of the ranges of the propositions and combinations of propositions involved.

I conclude by recapitulating these fundamental theorems in their simplest form as follows:

(1) Any probability is equal to or greater than zero ($a/h \geqq 0$).

(2) On any hypothesis the probability that a given proposition is both true and not true is equal to zero ($a\bar{a}/h = 0$).

(3) On any hypothesis the sum of the two probabilities, one that a given proposition is true and the other that it is not true, is equal to unity ($a/h + \bar{a}/h = 1$).

(4) On any hypothesis the probability that both of two propositions are true is equal to the product of two probabilities—one that on that hypothesis a particular one of the two propositions is true and the other that if the hypothesis and that proposition are both true the second is true also ($ab/h = a/h.\ b/ah = b/h.\ a/bh$).

Appendix.

Notation.

We shall use the general symbol $abc.../fgh...$ to denote the probability on the hypothesis that f, g, h, etc., are all true that the conclusion a, b, c, etc., are also true. In the simplest case this be-

comes a/h for the probability of a on the hypothesis h. We shall denote the contradictory of a proposition a by $\bar{a}$.

Later when dealing with a large number of probabilities on the same hypothesis the hypotheses may be omitted, where no misunderstanding will be caused, but it will be necessary in that case to remember that from the equation $a = b$ we cannot conclude that $ac = bc$ although if a is identical with b then ac is identical with bc. It will in this case be necessary to have an expression other than ab for the product of a and b and we shall use $a.b$.

Fundamental Theorems.

Stated in this notation and reduced to the simplest possible form consistent with generality the fundamental theorems derived in the text are as follows:

I. $a/h \leqq 0$.
II. $a\bar{a}/h = 0$.
III. $a/h + \bar{a}/h = 1$.
IV. $ab/h = a/h.\, b/ah = b/h.\, a/bh$.

Since by I

$$\bar{a}/h \leqq 0,$$

we have, adding a/h to each side

$$a/h + \bar{a}/h \leqq a/h\,;$$

but by III

$$a/h + \bar{a}/h = 1.$$

Therefore

$$1 \leqq a/h \tag{1}$$

Also

$$\begin{aligned} ab/h + \bar{a}b/h &= b/h.\ a/bh + b/h.\ \bar{a}/bh \\ &= b/h\ \ (a/bh + \bar{a}/bh) \\ &= b/h \end{aligned} \tag{2}$$

From this we have by simple transformation

$$\bar{a}b/h = b/h - ab/h \tag{3}$$

Substituting a for b in (2) we have

$$aa/h + a\bar{a}/h = a/h,$$

or by II

$$aa/h = a/h. \tag{4}$$

But

$$aa/h = a/h.\ a/ah\,;$$

therefore

$$a/ah = 1. \tag{5}$$

Since from I and (1) $0 \leqq b/ah \leqq 1$ we see from IV that

$$\text{If } a/h = 0 \text{ then } ab/h = 0. \tag{6}$$

Also since by IV $ab/h = b/h.\ a/bh$ we see that

$$\text{If } a/h = 0 \text{ and } b/h > 0 \text{ then } a/bh = 0. \tag{7}$$

Hence substituting $\bar{a}$ for a and applying III

$$\text{If } a/h = 1 \text{ and } b/h > 0 \text{ then } a/bh = 1. \tag{8}$$

From (8) and (1) we see that

$$\text{If } a/h = 1 \text{ then } ab/h = b/h. \tag{9}$$

But from IV directly we have

$$\text{If } a/h = 1 \text{ then } ab/h = b/ah. \tag{10}$$

Therefore

$$\text{If } a/h = 1 \text{ then } b/ah = b/h. \tag{11}$$

Substituting i for a and a for b this takes the form

$$\text{If } i/h = 1 \text{ then } a/h = a/ih = \frac{ah/i}{h/i}.$$

Since $i/h = 1$ if i is a proposition universally true or implied by the proposition h we have, if the omission of the hypothesis is taken to mean that any proposition of that class may be inserted as hypothesis,

$$a/h = \frac{ah.}{h} \tag{12}$$

This formula is interesting on account of its analogy to the fundamental assumption made regarding probabilities.

Since by IV $ab/h = a/h.\ b/ah = b/h.\ a/bh$ and by (1) b/ah and a/bh are each $\leqq 1$ we have

$$ab/h \leqq a/h \leqq 1 \text{ and } ab/h \leqq b/h \leqq 1. \tag{13}$$

Hence

$$\text{If } ab/h = 1 \text{ then } a/h = 1 \text{ and } b/h = 1. \tag{14}$$

Reverting now to equation (3) and omitting the hypothesis as constant we have

$$\bar{a}b = b - ab,$$

or substituting a_1 for a and $\bar{a}_2$ for b

$$\begin{aligned}\bar{a}_1\bar{a}_2 &= \bar{a}_2 - a_1\bar{a}_2 = 1 - a_2 - a_1 + a_1a_2\\ \bar{a}_1\bar{a}_2\bar{a}_3 &= \bar{a}_2\bar{a}_3 - a_1\bar{a}_2\bar{a}_3\\ &= 1 - a_2 - a_3 + a_2a_3 - a_1\bar{a}_3 + a_1a_2\bar{a}_3\\ &= 1 - a_1 - a_2 - a_3 + a_2a_3 + a_1a_3 + a_1a_2 - a_1a_2a_3,\end{aligned}$$

or generally for any number of propositions

$$\bar{a}_1\bar{a}_2\bar{a}_3 \ . \ . \ . = 1 - \Sigma a_1 + \Sigma a_1a_2 - \Sigma a_1a_2a_3 + \text{etc.} \qquad (15)$$

Where the enumeration extends over all compound probabilities similar to the one indicated under the sign.

If then $\bar{a}_1\bar{a}_2\bar{a}_3 \ . \ . \ . = 0$ and $a_ra_s = 0$ unless $r = s$; or in other words, if one of the propositions a_1, a_2, etc., must be true and only one can be true,

$$\Sigma a_1 = 1. \qquad (16)$$

This may be considered as an extension or more general form of Theorem III.

A similar analysis shows that

$$b\bar{a}_1\bar{a}_2\bar{a}_3 \ . \ . \ . = b - \Sigma ba_1 + \Sigma ba_1a_2 - \Sigma ba_1a_2a_3 + \text{etc.} \qquad (17)$$

Where the summation sign means that all similar combinations of a's are to be added, but the b remains constant.

Here also if $b\bar{a}_1\bar{a}_2\bar{a}_3 \ . \ . \ . = 0$ and $ba_ra_s = 0$ unless $r = s$ we have

$$b = \Sigma ba_1. \qquad (18)$$

This states in algebraic form Whitworth's postulate that (translating it into the language of propositions) if a proposition cannot be true unless some one of a set of other propositions is true nor if more than one of them are true, then the total probability of the first proposition being true is equal to the sum of the probabilities of its being true in conjunction with the individual propositions of the set.

Also if there be a set of propositions, c_1 c_2, etc., similarly related to $\bar{b}$ we have

$$\bar{b} = \Sigma \bar{b}c_1$$

and therefore

$$1 = b + \bar{b} = \Sigma b a_1 + \Sigma \bar{b} c_1$$

If then the probabilities ba_r and $\bar{b}c_r$ be all equal to one another and there be m of the first set and n of the second we have

$$1 = m.ba_1 + n.\bar{b}c_1 = (m + n).ba_1$$

$$ba_1 = \frac{1}{m + n}$$

Also from (18)

$$b = m.ba_1 = \frac{m}{m + n} \tag{19}$$

Suppose there are n propositions $a_1 a_2 \ . \ . \ . \ a_n$ and let $p^{(r)}$ be the average of the probabilities that r assigned propositions are all true so that

$$\Sigma a_1 a_2 \ . \ . \ . \ a_r = {}_nC_r p^{(r)}.$$

Then equation (15) takes the form

$$\bar{a}_1 \bar{a}_2 \bar{a}_3 \ . \ . \ . = 1 - np + {}_nC_2 p^{(2)} - {}_nC_3 p^{(3)} + \text{etc.}$$

$$= (1 - p)^{(n)}$$

if we assume that $(1 - p)^{(n)}$ is to be expanded according to the same law as $(1 - p)^n$. Also since by equation (18) each probability of the joint truth of r proposition is equal to the sum of the probabilities of combinations of x true propositions and $n - x$ false propositions which are such that the r propositions are included among the x, where x has all values from r to n inclusive, it follows that each such probability of x true and $n - x$ false is included in $\Sigma a_1 a_2 \ . \ . \ . \ a_r$ or ${}_nC_r p^{(r)}$ as many times as there are combinations r at a time among the x true propositions or ${}_xC_r$ times. If then $P_{(x)}$ denotes the total probability of exactly x true propositions out of n we have

$${}_nC_r p^{(r)} = \sum a_1 a_2 \cdots a_r = \sum_{x=r}^{x=n} {}_xC_r P_{(x)}. \tag{20}$$

With the definition we have given of expectation this means that the expectation of ${}_xC_r$ is ${}_nC_r p^{(r)}$ or $\Sigma a_1 a_2 \ . \ . \ . \ a_r$ or $Z^{(r)}$ say. But if u_x be any function of the number x of true propositions we have by the principle of finite differences

$$U_x = U_0 + {}_xC_1 \Delta U_0 + {}_xC_2 \Delta^2 U_0 + {}_xC_3 \Delta^3 U_0 + \text{etc.}$$

Therefore the expectation of U_x written MU_x is

$$\begin{aligned} MU_x &= U_0 + {}_nC_1 p \Delta U_0 + {}_nC_2 p^{(2)} \Delta^2 U_0 + {}_nC_3 p^{(3)} \Delta^3 U_0 + \text{ etc.} \\ &= (1 + p\Delta)^{(n)} U_0 \text{ symbolically} \qquad (21) \\ &= U_0 + Z\Delta U_0 + Z^{(2)} \Delta^2 U_0 + Z^{(3)} \Delta^3 U_0 + \text{etc.} \\ &= (1 - Z\Delta)^{(-1)} U_0 \text{ symbolically.} \qquad (22) \end{aligned}$$

If $U_x = 1$ if $x = r$ and $U_x = 0$ for other values of x then $\Delta^s U_0 = 0$ if $s < r$ and $\Delta^s U_0 = {}_{(-1)}{}^{(s-r)}{}_sC_r$ if $s \geqq r$ but in that case $MU_x = P_{(r)}$ so we have

$$\begin{aligned} P_{(r)} &= {}_nC_r p^{(r)} - {}_nC_{r+1} \cdot {}_{r+1}C_r p^{(r+1)} + {}_nC_{r+2} \cdot {}_{r+2}C_r p^{(r+2)} + \text{etc.} \\ &= {}_nC_r (p^{(r)} - {}_{n-r}C_1 p^{(r+1)} + {}_{n-r}C_2 p^{(r+2)} - \text{etc.}) \qquad (23) \\ &= {}_nC_r p^{(r)} (1 - p)^{(n-r)} \text{ symbolically} \\ &= Z^{(r)} - {}_{r+1}C_r Z^{(r+1)} + {}_{r+2}C_r Z^{(r+2)} - \text{etc.} \qquad (24) \end{aligned}$$

The probability of at least r true propositions is obtained by putting $U_x = 0$ if $x < r$ and $U_x = 1$ if $x \geqq r$ when $\Delta^s U_0 = 0$ if $s < r$ and $\Delta^s U_0 = (-1)^{s-r}{}_{s-1}C_{r-1}$ if $s \geqq r$.
We have thus

$$\sum_{x=r}^{x=n} P_{(x)} = {}_nC_r p^{(r)} - {}_nC_{r+1} \cdot {}_rC_{r-1} p^{(r+1)} + {}_nC_{r+2} \cdot {}_{r+1}C_{r-1} p^{(r+2)} -$$

etc.

$$\begin{aligned} &= Z^{(r)} - {}_rC_{r-1} Z^{(r+1)} + {}_{r+1}C_{r-1} Z^{(r+2)} - \text{etc.} \qquad (25) \\ &= Z^{(r)} (1 + Z)^{(-r)} \text{ symbolically.} \qquad (26) \end{aligned}$$

The expectation of number of true propositions is obtained by putting $U_x = x$ when we have

$$U_0 = 0,\ \Delta U_0 = 1,\ \Delta^s U_0 = 0 \text{ if } s > 1. \qquad \text{Hence}$$
$$Mx = np = \Sigma a_1 = Z. \qquad (27)$$

Also putting $U_x = (x - r)^2$ we have

$$\begin{aligned} U_0 = r^2,\ \Delta U_0 &= 1 - 2r,\ \Delta^2 U_0 = 2,\ \Delta^s U_0 = 0 \text{ if } s > 2, \text{ hence} \\ M(x - r)^2 &= r^2 + np(1 - 2r) + n(n-1)p^{(2)} \\ &= r^2 - 2npr + np + n(n-1)p^{(2)} \\ &= (r - np)^2 + n^2(p^{(2)} - p^2) + n(p - p^{(2)}). \end{aligned}$$

Putting $r = np$ and dividing through by n^2 we have

$$M\left(\frac{x}{n} - p\right)^2 = (p^{(2)} - p^2) + \frac{1}{n}(p - p^{(2)}). \qquad (28)$$

If we assume the n probabilities to be independent and each equal to p we have by the definition of independent probabilities $p^{(n)} = p^n$ for all values of n, so that equation (28) becomes

$$M\left(\frac{x}{n} - p\right)^2 = \frac{1}{n}(p - p^2) < \frac{1}{n}.$$

Let $F(h)$ be the probability that $(x/n - p) \geqq h$, then

$$M\left(\frac{x}{n} - p\right)^2 \geqq h^2 F(h).$$

Therefore

$$F(h) < \frac{1}{nh^2}. \tag{29}$$

However small h may be, so long as it is finite, this approaches zero in the limit when n is indefinitely increased.

Although this result follows from the assumption of equality and independence it may be seen to equally follow from independence without equality and even without independence provided the relation is such that the limit of $(p^{(2)} - p^2)$ when n is indefinitely increased is zero. This may be seen to be the case provided no probability is dependent on more than a finite number of others, because then $(n^2 - n)$ $(p^{(2)} - p^2)$ will bear a finite ratio to n. It will be the case, for example, if it is possible to arrange the probabilities in sets, each set containing a finite number and such that while there might be interdependence between probabilities of the same set there is none between probabilities of different sets.

Some Aspects of the Selection of Risks.

BY

RAY D. MURPHY.

Many actuaries are today called upon to deal with various questions which arise in regard to the selection of risks and which involve other considerations than those of a medical nature. In 1911 Mr. Arthur Hunter contributed an epochal paper (*T. A. S. A.*, XII, 1) entitled "Selection of Risks from the Actuarial Standpoint," in which he described a method of determining the value of a risk from its component parts, now commonly known as the "Numerical System." Since the presentation of that paper, the contributions that have been made to the Transactions relative to the selection of risks have dealt almost exclusively with the statistical results of different classes of impairments. Such mortality investigations are of the greatest importance to the companies, and particularly to their Medical Directors. It is not my purpose, however, to discuss the effect of such definite impairments, but rather to mention some of the considerations of a different character that are involved in the selection of risks for life insurance.

Since having an opportunity to work for several years in applying the Numerical System to the selection of risks, it has appeared to me that the discussion following Mr. Hunter's paper and the remarks that have since been made upon it in this Society have not been such as to present a fair criticism of its weaknesses as it is actually applied in practice or a fair estimate of the assistance that it is capable of giving to the selection officers of a company. I think, therefore, that it will be of advantage to re-state the place which that method logically fills in the present stage of the development of the science of selection.

If we could select a large number of persons of identical height and weight, family history, physical history, habits, occupation, residence, and other characteristics, we could in time be nearly certain what mortality rates would be experienced by risks identical with that class. I have said "nearly certain" for we are and always

shall be limited by having to apply knowledge of the past in order to estimate the future, and the future experience of the same class may be affected by new conditions such as the added development of medical and surgical science and improved methods of sanitation, or a greater popularizing of those practices which make for the conservation of health.

It is not possible, however, to obtain a set of absolutely homogeneous lives, not to mention the tremendous number of such sets that would be necessary to give us the experience under all types of lives presented to the companies. We are in fact studying the mortality results of classes of lives which have one, or more rarely two or three exceptional characteristics in common, with the other characteristics similar to the extent that no one of them or combination of them is thought to be distinctly unfavorable in any individual risk. Such studies leave us far from the desired goal of determining the degree of risk presented by a given individual life. If the applicant has an impairment, the general results of which we know by the results of a class, we wish to determine to what extent that individual is better or worse than the average of the class. He may vary from the average because of the particulars of the impairment or because his other characteristics are better or worse than the average of the classs. That these other characteristics may appreciably affect mortality we know by the surprising results sometimes obtained in impaired classes which have been subjected to a severe selection in such other respects.

Our difficulties are considerably increased if an applicant has two or more impairments, for the inter-relation of the impairments may be of great importance. It should not be forgotten, however, that where there is only one impairment there may be an inter-relation between it and some favorable feature, or between two favorable features.

Enough has been said to emphasize the intricacy and the inexactness that necessarily exist in any system of selection and to emphasize also that a lack of any attempt to proceed in some systematic way is likely, or practically certain, to lead to inconsistent action. This is particularly evident when a company's business is extensive enough to require more than one person to select the risks.

In this situation the Numerical System, as I have seen it applied, rests its case on the proposition that if, in the best judgment of the

selection officers, there is no inter-relation between two or more characteristics of the risk, the deviations from normal mortality on account of each characteristic should be summed algebraically. In other words, in the absence of any cause for believing that any one characteristic increases or diminishes the importance of another, the most reasonable guess is represented by the sum of the effects of the separate characteristics. This point should be noted carefully, because so many inferences have been drawn that the Numerical System involves summing the deviations from normal mortality for each characteristic, whether inter-relations exist or not.

As I have seen the System applied, deviations are never summed if it is believed that there is an inter-relation between two particular characteristics. Instead of such procedure a two factor table is prepared representing the company's judgment of the deviation in mortality on account of the combination of these two characteristics for various values of the two factors. A similar procedure may be followed where three characteristics are thought to be inter-related. As an illustration, attention is called to the tables presented by Mr. Robert Henderson and Dr. T. H. Rockwell (*T. A. S. A.*, XXII, 361–363) showing debits and credits for various abdominal measurements in combination with various ages and degrees of overweight, and the combination of tables giving the combined effect of family history of tuberculosis, age, height and weight.

It may therefore be said that the Numerical System contemplates splitting a risk up into only as many features as are not inter-related, and that as soon as it is discovered that interrelations exist such new combinations of features are treated as one element of the risk. Accordingly it appears that most of the serious criticism of the System disappears. I think it would indeed be fair to say that the only danger in the System lies in the temptation to rely on the summation of deviations in combinations of characteristics so unusual that they have not been previously considered and no decision has previously been reached as to the company's judgment of that combination. This is a temptation, however, that is not peculiar to the Numerical System. In fact where no systematic method is carefully worked out such decisions will be presented for individual judgment more often; for one practical advantage of the Numerical System lies in the necessity for adopting a definite

company view-point of the great majority of combinations of features that arise in practice.

It also appears that many companies which have not adopted this method of selection have found it to be a practical necessity to use tables of mortality deviations for such common features as height and weight, excess of abdominal measurements, and some other impairments. As far as I have had the opportunity of observing the results in such cases it has seemed to me that other features of the risk are quite commonly overlooked and that there are temptations toward unscientific selection that quite outweigh any temptations to error in the use of the Numerical System.

There has been at times an apparent confusion between the Numerical System of determining mortality deviations and the method of assessing extra premiums to cover increased hazards. In the majority of risks the rating for each characteristic is expressed as a constant percentage of normal mortality. This suggests the method of basing extra premiums on tables of mortality formed by increasing q_x by a constant percentage. If ages are rated up instead, the rating up will naturally be calculated as the equivalent of the former tables.

The Numerical System does not, however, preclude more accurate consideration of risks that display different types of mortality. For example, at least two of the companies using the System consider certain impairments temporary and decreasing in character. Scales of temporary extra premiums are charged in such cases. It would also be practicable to consider certain impairments productive of a constant absolute increase in q_x and charge extra premiums accordingly. In short, the amount of refinement which a company wishes to use in handling extra hazards is a matter of company policy, not determined by whether the company uses the Numerical System or not.

Another point which has raised doubts in regard to this method of rating risks is the large amount of credits that may apparently be built up in extreme cases to offset a vital impairment. It is probably true that in many cases with unusually large credits, some inter-relation exists between the credits. For example, credits for residence and the occupation of farmer in an agricultural State may not be entirely justified, because the low mortality of the State may be due in part to the large number of farmers included in it. A maximum limit beyond which no further credits will be allowed is

therefore a wise rule, although the maximum will probably affect an exceedingly small percentage of the cases. Sometimes a conservative rule is also adopted that credits, even within the maximum, will not be permitted to bring a risk within the standard class if an impairment of a certain severity exists. By such rules a company may take reasonable precautions against an extreme use of credits in particular cases.

It is the author's hope that these remarks upon the Numerical System will tend to clear up misunderstandings that easily arise in the minds of those who have not seen that method in operation. The installation of the System, however, requires most careful and extensive investigation, which it is not intended to minimize.

Aside from the general system to be employed in the selection of risks, there are particular questions bearing on selection which are also apt to engage the attention of actuaries. One of these is the amount of personal insurance that a given individual is entitled to carry on his life. Rough solutions of the question have sometimes been offered by stating the percentage of an applicant's income that should be spent for life insurance. Leaving out of consideration the fact that information in regard to income is usually approximate at best, such a solution is not a satisfactory guide. In the first place a man's income frequently consists of two parts, personal earnings and income from investments. The first portion only will cease at the insured's death and forms the basis for the great bulk of life insurance. Investment income is properly applied to life insurance for the purpose of inheritance and transfer taxes.

The maximum proportion of personal earnings or profits that should be applied to life insurance is a matter of importance in selection because medical examinations and inspection reports are not complete protection in discovering the facts which affect the risk, and an application for an excessive amount of insurance must be considered as an indication of a possible undiscovered hazard. The proportion of such income which may properly be paid out in insurance premiums depends upon the form of insurance. For example, let us assume that a company considers 15 per cent. of the income as the maximum applicable. Then if *A* applies for Ordinary Life insurance for such a maximum and *B* applies for the same face amount of insurance but wants part of it on the Limited Payment Life or Endowment form, it is evident that *B* is less likely to represent a bad risk than *A*, although *B* wishes to apply more

than 15 per cent. of his earnings to life insurance. Or again, *C* may wish to use only 10 per cent. of his earnings to pay premiums and yet buy more insurance on the term plan than *A* purchased. It would, therefore, seem that a company adopting the policy of limiting the percentage of earnings applicable to life insurance should make the proviso that the amount of insurance will be limited to what the fixed percentage will purchase on the Ordinary Life plan.

This proviso may suggest that the amount of insurance could be fixed as a percentage of earnings. This is unsatisfactory, however, unless there is a gradation with age at issue. If we look upon personal insurance as indemnity for the present value of a certain proportion of probable future earnings, it is evident that two men of equal earning capacity, one at age 40 and one at age 60, are not entitled to the same amount of insurance. It, therefore, appears to the author that the former rule using Ordinary Life premiums is to be preferred, particularly as the applicant himself will base his decision largely on the proportion of his income that he must pay for protection.

It is not the present purpose to suggest a definite limit for general use. It may be well to mention again that it is usually impossible to be sure of what an applicant's income is. Practice in passing upon such cases is required to develop judgment in coming to decisions on this point. An application for nearly the limit of insurance on a man who has no previous insurance would be more likely to represent adverse self-selection than an application for a small amount on the life of a man who already has the maximum but has acquired it over a long interval by frequent applications for relatively small amounts. Sometimes the details of the solicitation will apparently disclose that the agent was chiefly responsible for the desired over-insurance, but great stress cannot be placed safely on that argument, as it must be remembered that the applicant at least consented to the transaction.

When a company is handling a case of suspected excessive insurance, it is a common practice to limit the amount rather than to decline, if the suspicion of impairment is very doubtful. Cases where such a suspicion is fairly strong should be declined, because a limitation in amount will be no protection against probable excessive mortality on the amount granted.

The similar question of proper maximum insurance in favor of

a business firm on the life of one of its officers or responsible employees is an even more difficult one. The contingency to be insured is the loss to the business that would probably be caused by the death of the insured. Even a thorough internal investigation of the firm's affairs would probably leave the company in considerable doubt on this point, and any such investigation is impracticable. The insured may or may not be a man whom it would be difficult to replace, and this question must generally be left undecided. With such a possibility, therefore, that the insurable interest may be weak, there is all the more reason to examine the available facts carefully. The amount of insurance should be in keeping with the compensation the insured is receiving from the firm. A satisfactory rule might be to limit the insurance to, say, five times the annual compensation. The net worth and earnings of the concern will also furnish valuable information as to the propriety of the amount. The most difficult type of case is that of a concern in process of formation where almost no facts can be established. It might be said that the need for insurance on the life of the principal man is then greatest, but conservative action is necessary in many cases to avoid the effect of adverse selection, not only at issuance but with regard to the renewal of the policy in case the promotion of the company is unsuccessful. The probability of adverse selection on renewals is inherent in all business insurance because of the cases where the insurable interest will cease to exist on account of the discontinuance of the insured's business connection.

Another type of insurance that presents a peculiar problem is endowment insurance taken out in favor of a religious, charitable, educational, or fraternal institution on the lives of members. The purpose of the insurance is usually the raising of funds for endowment, or for repayment of a mortgage. In some cases it is desired to place the insurance on the lives of only a few members but for substantial amounts considerably in excess of any possible financial worth of the individuals to the institution. Aside from any legal questions that might arise as to the validity of the insurance in a case of that character, the acceptance of such amounts seems to the author to be contrary to sound underwriting principles. A large group of such lives should be expected to produce a mortality higher than normal, for it should be anticipated that in some instances it would not be overlooked that there would be an advantage

to the institution in selecting the person or persons of poorest prospects of longevity who could sufficiently qualify to pass the medical examination. A proper rule would, therefore, seem to be to limit the insurance on any one life to the probable financial worth of that life to the institution.

In the field of moral hazard an interesting question arises in cases where the applicant is adversely criticized because of his personal morals. In such a case the mortality may be expected to be unfavorable because of the possibility of violence, increased exposure to disease, and the general tendency toward unfavorable habits of life. I understand that most companies either decline such an application or issue a policy at standard rates if there is no other adverse feature. It is difficult to believe that, as a question of scientific underwriting, such a practice is correct if the company issues insurance at extra premiums. Probably some cases that are declined could be taken at substandard rates as far as mortality is concerned, though it would be extremely difficult to define the classes of risk. As a practical question, however, a company may wish to decline any case not acceptable at standard rates because it believes that its good-will may suffer in the community by the acceptance of a man of generally unenviable reputation.

Such a question of policy is an important element in considering applications from men who are under indictment or whose business practices are severely criticized with apparent justice. A company may also feel that it is unwise to enter into business relations with a man of dishonest intentions.

Another question regarding the general acceptance of risks which many actuaries will be called upon to consider is the maximum limit of acceptance on any life at each age at issue. It is assumed for the purpose of this discussion that the acceptance limit is the amount that will be actually retained by the company. The starting point in the problem is naturally the determination of the greatest loss to which the company is willing to expose itself at any age. Not only will it be desirable to consider the effect on surplus of variations in the mortality experience from year to year under the proposed maximum, but it will also be found advisable to consider the practical aspects of the problem. A company desiring to accept only what it will retain may feel it necessary in the interest of its agency force to adopt a somewhat more liberal max-

imum than a company which plans to accept additional amounts for reinsurance. If the company is subject to the New York law, limiting the amount of new business, and feels that it may be able to reach its limit before the end of each calendar year, it may be influenced to set a conservative maximum on any one life.

Having arrived by such considerations at the maximum figure, the question arises whether that figure should apply to all ages at issue. If the company is small and the limit correspondingly low, no modification with age at issue would probably be thought necessary. If, however, the limit is a large amount of insurance, as in the case of the larger companies, modifications appear advisable. Suppose, for example, that the limit is $150,000 and that the company insures applicants at ages 15 to 65 inclusive. It would undoubtedly refuse to insure any boy of 15 for such an amount, both because it would be practically impossible to have a boy presented who could establish an insurable interest of any such figure, and also because the habits of life which help to determine the nature of the risk have not been formed at that early age. It would, therefore, be preferable to determine what would be the greatest amount that would be accepted under the most favorable circumstances, and establish the maximum for age 15 for the guidance of the agency force as well as the officers charged with the duty of selection. Similarly, maximum amounts should be determined for the other ages below that at which the company would be willing to issue the full maximum originally determined.

At the older ages a large company will also probably wish to grade down its acceptance limit. A man at age 65 who applies for a very large amount of insurance is a questionable risk. His earning period in most cases is nearly over and the insurable interest has correspondingly weakened. The fact that there is virtually no mortality profit at such ages arising from the use of the American Experience Table may also influence the company in this direction, although loadings and surplus distribution may be arranged to provide an ample margin for contingencies at the older ages. It may even be felt by the Medical Director that it is more difficult to distinguish between standard and sub-standard lives over age 60 than at earlier ages. Assuming that for these reasons a lower limit is decided upon for age 65, limits may be graded upward as the age at issue decreases until the highest age at which the full maximum applies is reached.

Another point for consideration is whether such limits for the

various ages at issue will be granted at one time, or only upon two or more applications spread over a year or some other interval. If the limits are large it seems a wise policy to provide that such a maximum may be obtained only after two examinations have been submitted with at least one year intervening. The company would thus be permitted to watch the progress of a risk for a time before granting its most favorable action. In view of the tendency toward high mortality among policyholders insured for large amounts such a precaution is advisable. If that action is decided upon, an additional table of limits will be constructed to apply to applications submitted within one year's time. Much the same considerations as those mentioned in connection with the previous table may lead to a gradation at the younger and older ages at issue.

It will be appropriate to add that a company should not be willing to grant its respective limits to border-line risks, *i.e.*, risks which are granted standard insurance with some doubt about the correctness of the approval. Under the methods of selection employed in many companies it would be difficult to lay down comprehensive instructions regarding limitations of this nature. Where the Numerical System is employed a very convenient method is available, as it is possible to distinguish between different classes of risks that are accepted standard. Tables of lower limits may be prepared for cases in which the rating approaches the line between standard and sub-standard acceptance.

Companies doing a sub-standard business will ordinarily wish to establish special tables of limits for that class of insurance. The mortality of such risks cannot in general be forecast as accurately as the mortality of normal lives. The more severe the impairment, the more variation in mortality should a company expect, and consequently the more conservative should its limits become. A high limit might invite adverse self-selection of a more dangerous character than that experienced among lives which are apparently standard. A company may even wish to establish special low limits for a particular impairment if the mortality of that class is considered very doubtful, or if it is believed that the impairment may be of widely varying degrees of importance in different cases, opening the door to self-selection against which the medical examination is poor protection.

The author hopes that this discussion of some of the questions which the actuary meets in dealing with the selection of risks may lead to a free expression of views on this subject from others.

Discussion of Preceding Paper.

(WRITTEN DISCUSSION.)

MR. ARTHUR B. WOOD:

Since the Numerical Method of rating lives was first brought to the attention of the Society by Mr. Hunter, it has been passing through a process of gradual development and has been the subject of discussion on many occasions. Mr. Murphy considers that these discussions have not been such as to present either a fair criticism of its weaknesses or a fair estimate of its value and in the present paper he gives much additional information on many points of practice which heretofore may not have been thoroughly explained or understood.

We should read the present paper in conjunction with Mr. Hunter's original paper to properly appreciate the development that has been taking place and I am inclined to think we will then reach the conclusion that the objections originally advanced have been proven to be fundamentally sound.

While it has never been claimed for the Numerical Method that it can be automatically applied to all cases, possibly an incorrect impression may have been originally conveyed by the statement of the underlying principle as given by Mr. Hunter (*F. A. S.*, Vol. XII, p. 5). He says, "Were statistics available to cover each factor which enters into the make-up of the risk, it would only be necessary to sum up the various factors in order to obtain the total value, but even in the largest companies there are insufficient data to give a numerical value to every factor. So far as possible, however, a numerical equivalent should be given by the Actuary to the Medical Director for the unfavorable features of moment so that the latter may be in a position to determine approximately the extra mortality the Company is assuming for the unfavorable features of moment." The inference is that the final rating of the life is to be determined by the Medical Director, and is to be based on the numerical ratings furnished by the Actuary presumably by merely summing the various factors.

The principle of summing the debits and credits has been criticised as unsound. It leads to absurd results in extreme cases. The objection has been advanced that the mortality resulting from two unfavorable features is not necessarily represented by the sum of the numerical values assigned to each taken separately, and this has been proven correct by such subsequent investigations as have been made. It has also been held that the numerical value assigned to a particular impairment should not be reduced by the

full credit values assigned to the favorable points. For instance the numerical value assigned to a particular impairment may in fact represent the net result of its combination with certain favorable features, especially if derived from life assurance statistics based upon cases to which a somewhat severe selection has been applied.

To present the case fairly, however, the following extract from Mr. Hunter's paper should also be quoted. "I do not for a moment desire it to be understood that a numerical method is a cure for all ills. The automatic application to all cases would undoubtedly work harm in individual instances." In the discussion which followed, Mr. Gore expressed regret that Mr. Hunter from his experience had not given more information as to what should be done and what should be avoided in preparing a similar system. The present paper clears up many points of practice which were then in doubt. During the past eleven years much additional light has been brought to bear upon the subject, all of which tends to show that, while the system is an extremely valuable instrument in the selection of lives, it requires to be handled with great care and directed by those who are fully cognizant of the dangers to be guarded against. I am sure we all realize its value.

Mr. Murphy now sets forth the basic principle of the system in the following form, "In the absence of any cause for believing that any one characteristic increases or diminishes the importance of another, the most reasonable guess is represented by the sum of the effects of the separate characteristics." He also tells us that in practice "Deviations are never summed if it is believed that there is an interrelation between two particular characteristics. Instead of such procedure a two-factor table is prepared." And again, "The Numerical System contemplates splitting a risk up into only as many factors as are not interrelated . . . as soon as it is discovered that interrelations exist such new combinations of features are treated as one element."

Another criticism which has been made is that in its direct application the Numerical System takes no account of the variations in the nature of the mortality curve resulting from different impairments. As regards this Mr. Murphy says "The Numerical System does not preclude more accurate consideration of risks that display different types of mortality.—At least two companies using the system consider certain impairments temporary and decreasing in character. Scales of temporary extra premiums are charged in such cases." This I understand is a comparatively recent development of the application of the method.

In regard to the effect of the large amounts of credits which may be built up in extreme cases to offset a vital impairment, it has been found advisable in practice to establish a maximum limit beyond which no further credits will be allowed, and also to adopt

a rule that if an impairment of a certain severity exists credits will not be permitted to bring a risk within the standard class, that is to say, some rating will be imposed in any event.

I believe every one of us has been willing to admit from the outset the practical advantages of the system when intelligently handled, particularly in producing and maintaining uniformity of selection. The precautions and special regulations which have been adopted in practice would, however, appear to show that the criticisms which have been made have been valuable in bringing out clearly the dangers to be guarded against.

Improvements in the method of applying the Numerical System of rating will undoubtedly continue to be made as time goes on but in dealing with lives which present very unfavorable features we have still a long way to go before we can adopt numerical ratings and regulations regarding their use which will enable us to deal automatically with such risks. The expert judgment of the Actuary and Medical Referee on each such individual case cannot as yet be dispensed with.

Mr. Murphy also discusses a number of particular questions bearing on selection. The proportion of a person's earnings that should reasonably be applied to life assurance is a debatable question and a practical rule can hardly be established. This question was discussed from a different angle at the recent Life Underwriters' Convention at Toronto. Twenty-five percent was held to be not too large a proportion and some thought even this too low a figure. Naturally the Agent and the Actuary regard this, like many other matters, from different points of view. From the standpoint of selection, the amount of assurance in proportion to a man's ability to pay is a most important matter, and I agree with Mr. Murphy that in cases of suspected excessive insurance and in fact in all cases where there appears to be a definite moral hazard, the proper course is to decline.

The fixing of limits of assurance according to age for the guidance of the agency force as well as those charged with the work of selection is open to question. Speculative cases might more easily escape notice as the tendency would be to apply for the maximum only and then to look to another Company for additional assurance. Also the limit for a given age might reasonably be exceeded and no doubt would be exceeded in cases where the insurable interest is unquestioned. For instance insurances to provide for estate duties have altered our ideas as to the amount which should be granted in individual cases at the older ages.

As regards establishing lower limits for border-line and substandard cases, I am not altogether in accord with Mr. Murphy's suggestion unless there is a very reasonable doubt as to the suffi-

ciency of the rating. In dealing with underaverage lives we should aim at as close an estimate as possible of the probable mortality and fix our terms accordingly, and if we err it should be on the side of safety. If we are satisfied that the terms imposed are probably sufficient we are justified in giving the limit of assurance. If a normal life, aged 40, is acceptable for the maximum why should not a man of 35 who is accepted as at age 40 also receive the limit, if we are reasonably confident that a rating of five years amply provides for the extra mortality? If, however, we are dealing with a serious impairment the effect of which is not yet sufficiently well known to enable us to determine the rating with confidence, it is wise to restrict the possible loss by reducing the limit applicable to such cases.

MR. FRANKLIN B. MEAD:

Mr. Murphy's paper is comprised of two sections, the first a general consideration of the rationale of the Numerical System and the other consisting of specific aspects relating to selection in connection with certain types generally termed as non-medical.

In concluding the first section the author expresses the hope that his "remarks upon the Numerical System will tend to clear up misunderstandings that easily arise in the minds of those who have not seen that method in operation." It seems to me that the author has been highly successful in his treatment of this phase of the subject and that the purpose of his remarks will be largely fulfilled. Even at this late day there are many who still regard the Numerical Method as one according to which certain percentages are rigidly assigned to the various insurance aspects of a risk and then rigidly assessing the risk in accordance with the mortality charge resulting from the rigid summation of the mortality values for these factors. This rigid summation method, which is indeed a numerical method, is the conception of many as *The* Numerical Method, which is condemned in many quarters. The Numerical Method is a broad and telling process of arriving at a numerical factor as the mortality value of a risk with some reference to incidence, particularly in certain types, and, while it indeed may in many cases be the summation of the factors for the individual aspects it may involve extra percentages added for certain combinations which cause extra hazard or it may even have deductions from the sum of the factors for two or more aspects which in individual cases may not be mutually exclusive and it may also involve an adjustment after the summation is completed if the results arrived at are found to be inconsistent after reviewing the various influencing factors in combination. To summarize, the Numerical Method may be defined as the method by which an attempt is made to affix a numerical

value to the risk as a whole by the employment in so far as possible of definite fixed standards for the various aspects of the risk.

In the second section of his paper regarding specific aspects the author first treats of the important consideration of the amount of insurance that a given individual is entitled to carry on his own life in proportion to his income. It seems to me it is not feasible to establish any standardized method of dealing with this question such as establishing a relation between the amount of the insurance premiums and the reported income of the applicant for the reason that reported incomes are usually very inaccurate. They are usually underestimated although sometimes overestimated. Furthermore, there are certain other aspects which influence the subject and it seems to me that each case from the aspect of income must be treated individually and acted upon by the trained underwriter who has had considerable experience in this direction and who is able to grasp comprehensively the *atmosphere* of the risk.

The author subsequently deals with the question of corporation or business insurance. It seems to me that one aspect of this subject should be continually borne in mind and that is that the need for the business insurance may terminate at some future date, either early or late, and that if the applicant should happen to be impaired at that time arrangements will be made to continue all or a large part of the insurance for the applicant's personal benefit, thus involving a heavy selection against the company for undoubtedly there will be large cancellations on the other type at this point where the risk is first class physically in every respect.

The proposition to limit the amount of acceptance on a standard basis to borderline risks does not appeal to me. It seems to me that the company doing a substandard business has a much better course. I see no reason why it should grant insurance for a limited amount on the doubtful standard basis. Why not play the safer course and charge for the doubtful risk and go the limit? I see no reason for not going the limit on a risk if we are sure we have all the facts. If we have any doubts as to the facts it seems to me it might be appropriate to limit the risk but where we believe we have the facts and are doubtful as to the significance of those facts we should not charge a doubtful rate but charge a safe rate and go the limit. All will recall the old Specialized Mortality Experience which was unfavorable as to risks which were accepted for limited amounts of insurance. While doubtless our course with many of the types entering into that particular experience is clearer and more accurate today and we can more successfully cope with the situation, we are in no better position today to be more successful as to risks of which we are doubtful than the companies were at the time the risks were accepted for the companies which embraced the class in the Specialized Investigation just referred to. There-

fore, in view of the Specialized Investigation why persist in the same relative course and not heed the warning of that Investigation? The principle involved today is the same as it was then.

This practice of limitation leads to the shopping around of risks which seems to be on the increase in the larger cities, as a result of which the companies in general seem to be vying with each other to secure this business which is like a game of heads you win, tails I lose, for the company only secures the business if it has the low rating and it seems to me that it must necessarily follow that a high mortality will be experienced on this type of risks. My attention has recently been called to cases of this type taken standard for $5,000 where the company's limits were up in the six figures. This proportion, it seems to me, is enough to brand the practice as pernicious. Should we let competition get the better of us to this extent? As previously intimated, this unhealthy condition is widespread just now and the tendency should call for drastic action.

MR. W. R. HALLIDAY:

I have been experimenting on the numerical rating system for the past twelve months and have come to the conclusion that it is as useful to small companies as to large ones.

I have here a copy of the rating sheet we use. It looks elaborate but in actual handling a case takes no longer than it did under the old method.

Every case is rated with a number, being its mortality percentage ratio. In addition, every substandard case, that is, cases rated 125 per cent. or more, has attached to the rating one of the letters I, C, or D, indicating that the extra mortality is immediate, constant or deferred. These ratios with or without initial are carried through all the records for purposes of investigation at a later date.

All substandard cases rated I or C are rated up in dollars per $1,000. Those rated D are rated up by age addition. Of course a case rated 135 per cent. is charged the same premium whether it is an I or D case, but if it is I or C, the guaranteed values are those at the real age. If it is a D case, the values are those of the rated up age, and the reserves of course are carried at the rated up age.

Tables are supplied showing the rating up in years for each class of policy, for each age at entry, and for ratings from 125 to 200 per cent. at 5 per cent. intervals.

Once a month a summary is prepared by the Medical Department showing the ratings of all cases during the month arranged as shown by Mr. Hunter in Vol. XII, p. 6. The summary shows percentages by both cases and amounts.

Several small companies, one very small, are using the system with

great satisfaction to both agents and Home Office staff. Great pains, however, were taken at the start to instruct the agents in considerable detail as to the working of the system.

The monthly summaries have furnished some useful information. Taking two companies of about the same size, it is found that one company gives figures closely approximating to Mr. Hunter's Table above referred to. The other, with equally skilled underwriters, never comes near this table and claims that it does not get the same class of business as the other company. As to that I do not know, but I am disposed to think it bears out the opinion held by some Actuaries, that the Medical Department on the average will rate cases about 10 per cent. higher than the Actuarial.

In one company it was found that while the rating clerks were handling standard cases, their work was quite satisfactory, but when they handled substandard cases, their ratings were much too high.

In another company it was found that the numerical ratings on the larger cases were lower than the average.

The use of such a monthly summary provides the only known immediate check on the work of the Medical Department of the Company, and the adoption of some such standard as that indicated by Mr. Hunter would seem to be useful.

RATING SHEET

APP. NO.	NAME	PLAN	AMT.
_____	_____	_____	$_____

INSURANCE RECORD:		BUILD:	
Other Companies	$.....	Height	....Ft....Ins.
In Force (this Company)	$.....	Weight	.....Lbs.
Discontinued	$.....	Age (Nearest Birthday)	.....
Incompleted	$.....	Mortality (Build and Age)	.....
Declined	$.....	Chest....Ins. Waist....Ins.	.....Extra
IMPAIRMENT RECORD:		Correction For	.....
		" "	.....
		Total Build Mortality	.....

RATING SHEET—*Continued.*

MORAL HAZARD:		RATING:	
Identification		Plan	
Plan		Occupation	
Age		Habitat	
Occupation		Personal History:	
Beneficiary			
Insurable Interest		Family History	
Agent		Build	
Examiner		Physical Condition	
Finances			
Women		Habits	
Vagueness		Moral Hazard	
MEDICAL EXAMINER:		Total by Rules:	%
Authorized		Double Impairments + or −	
Class		Credits Not Allowed	
Date of Examination		Impairments Not Charged	
Report Completed?		Mis.	
Report Penalized?			
INSPECTION:		Final Rating	%
Regular Alternate Sp. Service		Extra Hazard "I." "D," or "C"?	
COMPANY RULES:		Double Ind.? Dis.? Young Lt. Wt.?	
		Accept $ As Applied For / Rated Up / As / For Reinstatement.	
REMARKS:		Reinsure $ Co.	
		Decline	
		Postpone For	
		Date Rated By	

(ORAL DISCUSSION.)

MR. E. E. RHODES:

It seems to me there are some rather elementary facts which ought to be kept in mind in considering this subject of Selection. One is that practically all insurance is written at the urgent solicitation of an agent; there is very little insurance voluntarily applied for; the second is that very few men are over-insured; and the third is that there are very few men who prefer life insurance to life.

I think that Mr. Murphy has approached his subject a little too seriously; and that there is no real necessity for trying to formulate a rule regarding the maximum amount of insurance that an individual should carry, beyond the general rule fixing the maximum amount of insurance which the company will carry on any one life.

It doesn't seem to me that a man's income is the real criterion. If I were in business and my affairs were in a hazardous condition I think I would want insurance more than I would if I were prosperous; and I think that I would be justified in taking it, and that a company would be justified in giving it to me. The only real, practical objection that I can see to granting what we may consider over-insurance, assuming, of course, that there is no moral hazard, is the probability that the business will not stay on the books. Aside from that, I would not be very much concerned, if the discrepancy between the amount applied for and the apparent income was not too great.

Then there is the question of business insurance to which Mr. Murphy refers. The difficulty there, as I see it, is not with respect to the amount which may be carried, but rather to the legality of it; and the danger that a stockholder may establish the fact that the funds of the corporation have been misapplied.

With regard to insurance taken out in favor of religious and other institutions, Mr. Murphy suggests that the proper rule would seem to be to limit the insurance on any one life to the probable financial worth of that life to the institution. Is that a practical rule? Take the members of a class endeavoring to establish an endowment for their alma mater—the financial worth of the members of that class to the institution is nil. We would not regard it at all if we had an opportunity to write that kind of insurance. Even if it were intended to place the entire amount upon only a few members of a college class I see no objection whatever to doing it. There is a possible danger that poor lives will be selected, but I don't think that is the rule. I know that in one case it was decided to place the insurance upon a few members; and the class voluntarily selected among those upon whom the insurance should be placed, the girl who was known as the Venus of the class; her

measurements were more nearly perfect than those of any other member. Unfortunately for her, while she was all right outside, she was not right inside; and she could not be one of them.

I like Mr. Murphy's idea of having double limits, and requiring that a policyholder shall be insured for a certain length of time before he gets the full maximum. It is a rule we have used for some time, and it works very well.

Generally, as I said in the beginning, I think Mr. Murphy has approached the subject from too serious a standpoint. At the same time his paper is a very interesting one, and we are all indebted to him for its presentation.

MR. HENRY MOIR:

I have read this paper with the greatest possible interest and enjoyment. Naturally my first thought turns to the Numerical System, and perhaps that part of the paper I have read most carefully; not always in complete agreement with the writer. He has brought out some of the features of the Numerical System very well; but I have a feeling that a good case is not furthered by claiming too much for it. I have always felt that there is much good in the Numerical System, but that some of those who advocate it claim a little more than it deserves. For instance, I quote from Mr. Murphy's paper:—

> "It may therefore be said that the Numerical System contemplates splitting a risk up into only as many features as are not interrelated, and that as soon as it is discovered that interrelations exist such new combinations of features are treated as one element of the risk. Accordingly it appears that most of the serious criticism of the System disappears."

I am going to ask Mr. Murphy to think that over carefully, and perhaps strike out the last sentence; because I think it does not follow at all. The first sentence is excellent; and the first sentence results from the criticisms which various people applied to the Numerical System. When the Numerical System was first brought out that first sentence could not have been expressed so clearly. It is because of the criticism that has been introduced that we have realized that the interrelations are so important; and Mr. Murphy frankly admits that; he also admits that these have been taken into consideration.

How are we to determine interrelations? There were originally eight groups into which the Numerical System was divided. Who can tell which of them are interrelated? The eight groups are:— (1) Build, (2) Family History, (3) Physical Condition, (4) Personal History, (5) Habits, (6) Occupation, (7) Habitat, (8) Moral Hazard (*T. A. S. A.*, XII, p. 5). Build—Physical Condition, I think are interrelated. In the same way, Family History—

Habits. It sounds strange to suggest that; but in my own personal examination of risks I have been struck very much by the fact that the men of loose habits in a large proportion of the cases show weak family history. Is it not quite possible that their habits may result from some physical weakness coming down through heredity?

The main point is that interrelations are important; and the scope of them is unknown. While I personally have always conceded the immense value of the Numerical System, especially for large companies, and for the saving of labor, still I do not feel that it is fully developed as a scientific system. I sincerely hope that the day will come when it will develop into a system upon which we can rely with greater belief than we do our own judgment.

I don't know that there is much more in the paper that I wish to discuss; I am in such thorough agreement with the great part of it.

There is another little thing on this Numerical System—Mr. Murphy says:

> "I think it would indeed be fair to say that the only danger in the System lies in the temptation to rely on the summation of deviations in combinations of characteristics so unusual that they have not been previously considered and no decision has previously been reached as to the company's judgment of that combination."

Yet later on he points out another danger himself—that there might be more credits than one very large, vital impairment; and that therefore credits must be limited or some other plan adopted to get rid of that danger. These are perhaps small matters.

The limit of personal life insurance, along the line of Mr. Rhodes' remarks, is also an interesting subject. It is hard to set down a definite limit. I know one man who said he put all his savings into life insurance; he was such a thorough believer in it. He put a great deal more than 15 per cent. of his income into endowment policies. I think he was not over-insured; he trusted life insurance as much as he would a savings bank. He was insuring far beyond the 15 per cent. limit stated here. I think that is a matter to be largely determined by individual circumstances: and sometimes by the effectiveness of the solicitation of the agent. I think as actuaries we cannot too strongly deprecate the over-persuasive agent, who sometimes gets a man to take insurance far beyond what he can afford, and which will be carried but a short time. This is not good for the company or for the agent.

I wish to thank Mr. Murphy for the very excellent paper submitted.

MR. ARTHUR HUNTER:

As pioneers, Dr. Rogers and I have suffered in certain respects from the publication of our ideas on the Numerical System. Some

of those who have been opposed to it have assumed that we were not taking precautions against carrying the method to an extreme. Criticism is always helpful in developing a new system, but some of the critics have not read carefully what Dr. Rogers and I have said on the subject. One of the criticisms which has been made—that we did not consider the interrelationship of certain impairments—is not in accordance with the facts. We knew perfectly well at the inception of the system that if, for example, a man were a saloonkeeper and his habits were unsatisfactory, we should not add together the ratings for saloonkeeper and for over-indulgence in alcohol.

On the other hand, if we had an applicant who was light weight, with a family history of tuberculosis, we did not add together the ratings for the two factors of light weight and tubercular family history, but made a substantial addition to the combined ratings. From the very beginning we also guarded against offsetting several favorable credits against an impairment of moment. If a man had a serious impairment he always obtained substandard insurance irrespective of his credits. With regard to the interrelation of impairments, it must be realized that at the inception of the Numerical System practically the entire available data referred to "single" impairments. It is only in recent years that any company has had enough experience to determine the effect of two or more impairments and their relationship.

Mr. Murphy has given us a clean-cut expression of his opinions regarding the selection of risks, and, in general, they may be safely followed. He has gone further than I would care to go—for example, with regard to determining the amount of insurance. It is worth while, however, bringing this matter up for discussion in a frank way as we now have the additional factor of disability benefits to consider. Mr. Murphy's paper can be read with profit by the members of the bureaus which handle the selection of risks.

MR. CHARLES A. ELLIOTT:

Mr. President, we in Australia have long watched with a great deal of interest the development of the Numerical System of rating. We have had no experience to date, because no office in Australia has so far adopted it. We feel that in our business there are many substandard cases to which the Numerical System as we know it is not satisfactorily applicable, especially in cases involving moral hazard. With regard to moral hazard we feel that there is no way of applying the Numerical rating satisfactorily.

With regard to the limit of risk we are inclined to look not so much at a man's income, as at the amount we assume from a knowledge of his mode of life he is capable of saving. Some men will save a far larger proportion out of their income than others; and it depends very much upon your personal report regarding the

man as to what amount you think he will be able to save. We look to that, not so much with the object of protecting our funds against premature claims, as to safeguard against any increase in our lapse rate.

We feel that a great deal has yet to be done with regard to the Numerical System of rating; and especially that any office which adopts one of these systems must use it with discretion. The actuary who introduces such a system must recognize that he has not relegated his responsibility; but that there will always be cases which will require special treatment and that he must be always on the lookout for them. Furthermore, this is no problem in pure mathematics; having once ascertained your numerical ratings you cannot consider the problem solved, once and for all. You must be constantly on the watch for changing rates of mortality, or changes in the knowledge of what the rates of mortality are.

(Author's Review of Discussion.)

MR. RAY D. MURPHY:

It may be well to state frankly at the outset that my chief purpose in writing this paper was to attempt to correct the unfortunate and incorrect impressions that students and others have apparently gained regarding how the Numerical System was actually operated in practice. There has been frequent criticism of the System based upon the absurd results that would be obtained if individual ratings for a fixed set of characteristics were invariably summed irrespective of interrelations. It is vital to any correct appraisal of the System to understand that these absurd results do not happen because interrelations are taken into account. Mr. Moir objects to my statement that "Accordingly it appears that most of the serious criticism of the System disappears." Our difference is evidently one of definition. The serious criticism to which I alluded is that just mentioned. In the term "Numerical System" I include the rules and limitations under which it is operated. It is because the System has been frequently criticized upon the assumption that such limitations do not exist or are not a part of it that unfortunate impressions have been created.

Mr. Wood and Mr. Moir both assume that the present rules and limitations under which the System is operated are the results of such past criticisms. Mr. Hunter is, I think, the only member of the Society who is familiar with all the history of the subject. I have often wondered whether his paper in 1911 fully enlightened us on the limitations which were included in the System at that time. In reviewing the discussions of his paper he asked "Are we to be contented with the old method which is partly based on impressions and is, at the best, more or less arbitrary, or are we willing to accept a scientific method *with limitations* which can be

largely removed by the use of judgment?" And, in commenting on the absurd results which Mr. Macauley produced by the use of credits, Mr. Hunter stated, "I have never observed one in practice with a lower rating than 45 per cent. *in the system adopted by my company.*" In discussing my paper he makes the following interesting comment: "We appreciate the criticisms which have been made; some of them enabled us to see much more clearly than we would otherwise have done; but originally we had and did take account of most of the suggestions made."

Whatever may be the historical details of the subject, I wish to testify to the value of the System in practice. It has been used in the Equitable for seven years to our satisfaction. I do not wish to take the space to describe in detail all the advantages we have found in it. As enthusiastic as I am for it, I should not claim, as Mr. Moir concedes, that it is a saving of labor. Other systems can, I think, be operated with as little if not less labor. In this connection I wish to correct a wrong impression which Mr. Wood evidently has of the System. This System does not relieve the Medical Director of seeing and using his best judgment on cases which present unfavorable features. I should also like to say to Mr. Elliott that the question of moral hazard may be handled under the Numerical System with the same freedom of judgment as is used under any other method.

In dealing with the other parts of my paper, Mr. Wood and Mr. Mead are apparently in favor of granting the company's limit to many under-average lives. I think there are some impairments, the mortality arising from which is sufficiently known to permit a company to be somewhat liberal in this respect. In general, however, I should not consider this a wise practice, because statistics of classes of under-average lives are not as conclusive as we would wish them. Neither do I concur in Mr. Mead's suggestion to rate doubtful cases consistently on the basis of an unfavorable interpretation of the facts. A company doing that and granting liberal substandard amounts is apt to find that, as a result of the submission of the same cases to several companies, it is getting the poorer of the doubtful cases for substantial amounts, while the companies which are trying to rate with a closer degree of accuracy are obtaining the more favorable cases. I have not noticed the conditions which he mentions in his last paragraph, and I wonder whether such a method as he advocates might produce such an impression in the company practicing it.

Mr. Rhodes limits his comments to the latter part of my paper, which he thinks I have approached too seriously. He believes there is no real necessity for trying to formulate a rule regarding the maximum amount of insurance that an individual should carry, beyond fixing a general company maximum. The first thought that arises in my mind in reading his comments is, how much of the

extra mortality on large cases in this country is perhaps due to the fact that companies may not have formulated this question seriously in their underwriting departments or in the minds of executives who sometimes give the final decision on such large cases? Certainly cases cannot be handled by rule of thumb where considerable doubt exists as to the applicant's income, but, in my judgment, the skillful underwriter makes his decisions with some sort of guiding principle in the back of his mind. It is important that he be alive to the very small percentage of cases of excessive insurance that are presented, for an unfavorable mortality may result even if the great majority of risks are sound. Mr. Rhodes states, "The only real, practical objection that I can see to granting what we may consider over-insurance, assuming, of course, that there is no moral hazard, is the probability that the business will not stay on the books. Aside from that, I would not be very much concerned." The difficulty is that you cannot be sure your assumption that there is no moral hazard is correct. Furthermore, physical histories and impairments are not always disclosed in the papers. This is the reason why an application for an excessive amount should be viewed with grave suspicion.

Mr. Rhodes has quoted an amusing illustration in regard to insurance taken out in favor of religious, educational, or other institutions on the lives of members. The incident does not appear to support his point of view particularly well. I agree with his statement that "There is a possible danger that poor lives will be selected, but I don't think that is the rule." I disagree, however, with his conclusion that there is no objection to carrying substantial amounts on a few members, much in excess of anything that would be warranted by the insurable interest. The majority of risks may be good, but the total mortality poor. It is to guard against the acceptance of a minority of relatively poor risks that safeguards seem necessary where the circumstances are such as to encourage the selection of the weakest lives that the company may be induced to accept.

In closing, I wish to thank the gentlemen who have discussed the paper and to express the hope that others will find the opportunity in the future to present additional papers on the general subject of the selection of risks.

Mortality Study of Impaired Lives.

(*a*) Inflammatory Rheumatism.
(*b*) Tuberculosis of Lungs and Blood Spitting.

BY

ARTHUR HUNTER AND DR. OSCAR H. ROGERS.

In a paper which we read before this Society in October last, we discussed the insurance significance of certain medical impairments, and wish now to add the results of our studies of certain other of them, a history of inflammatory rheumatism, mitral regurgitation in connection with a history of inflammatory rheumatism, a history of blood spitting, and of old lung trouble or cured tuberculosis.

All of the risks contained in these groups were insured by the New York Life on underaverage plans, during the years 1896 to 1920 inclusive, and studied up to the policy anniversaries in 1921. The study is by policies and not by lives nor by amounts insured. During the years 1896 to 1906 inclusive, these policies were issued in a special class as to dividends and those risks that were thought to be more seriously impaired had also a lien placed against them. From 1907 to 1920 inclusive, they were issued with an advance in age.

There is no table of mortality in existence which represents the experience of this Company on standard lives during the entire period covered by this investigation. In the earlier years of that period the Company's general mortality was represented by the Compound Progressive Table, in the later years by the Medico-Actuarial Table and in the intermediate period somewhere between these two tables. In order that the mortality ratios published in this paper may be compared with those of other companies engaged in similar investigations, we have employed the Medico-Actuarial Select Table. At the same time, in order to give a more accurate expression of the mortality in the classes under discussion compared with the Company's general experience on standard lives, we have also used as a standard a table midway between the Com-

pound Progressive and the Medico-Actuarial. The ratios thus derived appear under the heading, "Ratio of Actual to Expected Deaths by the Company's experience on Standard Risks." It will be understood, of course, that these ratios are approximate only.

During the period under consideration, the standards employed by the Company in placing valuations upon these lives have changed from time to time, according to the information we have been able to secure, so that the selection has varied somewhat in severity. We may also say that, in order to increase as much as possible, consistent with reasonable homogeneity, the material contained in these classes, we have included a few minor impairments. We are satisfied however, after a careful review of the records, that the results of this study cannot have been modified as much as 10 per cent. of the M.A. Table by that procedure, and we believe that it is highly probable that it has not been influenced by more than 5 per cent. by their inclusion. When interpreting the results of this investigation, all of these facts should be taken into account.

History of Inflammatory Rheumatism.

The material, 5,876 cases, was divided according to the number of attacks and also to the time elapsed since the last attack as follows:

	Number of Cases.	Actual Deaths.	Expected Deaths by M.A. Table.	Ratio of Actual to Expected.	
				By M.A. Table.	By Co's. Experience on Standard Risks.
One attack within 2 years.....	1,276	84	52.5	160%	145%
One attack within 3 to 5 years.....	766	63	38.6	163	150
One attack more than 5 years ago...	1,667	178	122.9	145	135
Two or more attacks within 2 years .	1,174	112	75.2	149	140

There were three other groups in which the experience was not sufficiently large to justify publication—"One attack at some time in the past, not specified," "Two or more attacks within 3 to 5 years prior to application," and "Two or more attacks 6 or more years prior to application." The aggregate experience in these groups, probably on account of accidental fluctuation, was somewhat better than any of the four groups submitted.

These results do not appear to be entirely consistent, as they show a higher mortality among persons with one attack than with two or more attacks, the last one within two years prior to the date of application. This may possibly be due to accidental fluctuation or to the more careful selection practiced in the latter cases.

Combining the data for the four groups, the following are the results for ages at entry 15 to 39 and at 40 and older.

Ages at Entry.	Actual Deaths.	Expected Deaths by M.A. Table.	Ratio of Actual to Expected.	
			By M.A. Table.	By Co.'s Experience on Standard Risks.
15–39.....	197	120.8	163%	145%
40 and over.....	240	168.5	142	135

An analysis of the four groups showed that in two of them the relative mortality was lower at the younger than at the older ages, while in the other two the reverse was the case. Clearly this experience does not justify us in making in our ratings any differences based upon ages at entry.

The deaths from heart disease were 20 per cent. of the total deaths, a high rate compared with that among standard risks.

In drawing deductions from this experience it should be remembered that applicants with a record of an attack of inflammatory rheumatism of ordinary severity were usually given standard policies and are, therefore, not to be found in the data now presented. The attack of rheumatism must have been sufficiently severe to call for a rating in order to bring them within the group we are now studying. Our experience therefore shows the effect on mortality of the more severe attacks of inflammatory rheumatism and should not be compared with the experience with carefully selected standard lives to which standard insurance had been granted.

The ratings which we employ at the present time are as follows:

	Acute Articular Rheumatism.		
	Within 1 Yr.	1 to 5 Yrs.	Over 5 Yrs.
One attack.....	+30	+20	+10
Two or more attacks.....	+40	+25	+15

While our standards have varied during the twenty-five years

covered by this investigation, we have constantly adhered to the policy of decreasing the rating with the lapse of time since the attack. The more recent views of the medical profession regarding the causation of rheumatism and the treatment of it by the elimination of the causes of infection, leave us satisfied that we have done this. Acute articular rheumatism is now looked upon, and is being treated as, an infectious disease and recurrences of it are being avoided by the removal of foci of infection, usually in the tonsils, the teeth or the nasal sinuses. Even with this improved mastery over the disease, we believe that the testimony is sufficient to justify insurance companies in looking upon a severe attack of acute articular rheumatism during the years immediately after the attack as a distinct impairment. In our ratings we have taken account of the increasing knowledge of rheumatism in that our standards are more favorable than our experience.

Rheumatism and Mitral Regurgitation.

In our paper published in 1919 on "Heart Murmurs, Their Influence on Longevity," we gave the experience of the New York Life Insurance Company in a group of cases of mitral regurgitation, associated with a history of inflammatory rheumatism. The mortality in this group was very high, a result so unexpected that we have made a further investigation of our material in order to determine whether or not there has been any change in the last three years.

Our report of 1919 covered 1868 cases insured from 1896 to 1917 both inclusive. The present study represents that old material plus such cases as have accumulated down to 1920 inclusive, carried to the policy anniversaries in 1921. As in our former study, we have divided the cases into two groups, (*a*) those with little or no hypertrophy, (*b*) those with moderate hypertrophy. Cases with a substantial amount of hypertrophy have been declined altogether. As in the preceding group, the attack of rheumatism was in all cases sufficiently severe and recent to call for a rating.

With regard to the cases in which there was a moderate degree of hypertrophy, the material, though of small volume, is given subdivided by number of attacks of inflammatory rheumatism.

MITRAL REGURGITATION WITH LITTLE OR NO HYPERTROPHY WITH HISTORY OF INFLAMMATORY RHEUMATISM.

	No. of Cases.	Actual Deaths.	Expected Deaths by M.A. Table.	Ratio of Actual to Expected.	
				By M.A. Table.	By Co.'s Experience on Standard Risks.
One attack	1,426	169	64.1	263%	240%
Two or more attacks	612	106	30.3	350%	320%
Total	2,038	275	94.4	291%	270%

MITRAL REGURGITATION WITH MODERATE HYPERTROPHY WITH HISTORY OF INFLAMMATORY RHEUMATISM.

	No. of Cases.	Actual Deaths.	Expected Deaths by M.A. Table.	Ratio of Actual to Expected.	
				By M.A. Table.	By Co.'s Experience on Standard Risks.
One attack	346	51	14.9	343%	315%
Two or more attacks	154	35	6.8	515%	470%
Total	500	86	21.7	396%	360%

This study strengthens the conclusion drawn from our previous experience that these cases of heart murmur with a moderate degree of hypertrophy call for a high rating and that those with considerable hypertrophy are practically uninsurable. The hazard involved in "Mitral regurgitation with a history of acute articular rheumatism" is much greater than the sum of the separate ratings. Those who employ the numerical method of valuation should make due provision for this.

The percentage of deaths from organic heart disease was very similar to the previous experience. Of the total deaths in the group of mitral regurgitation with little or no hypertrophy, 56 per cent. were from heart disease, and in the group of those with a moderate degree of hypertrophy 62 per cent.

A comparison of the age distribution shows that 20 per cent. of these cases were among applicants 40 years of age or over, while among the group of those with a history of acute articular rheumatism without a heart murmur at the time of application, the corresponding ratio was 33 per cent.

We may add, by way of a sidelight upon this subject, that in an analysis of 800 cases of mitral regurgitation a history of acute articular rheumatism was disclosed in 14 per cent. In making this analysis we took an equal number of cases with and without hypertrophy. There was no practical difference in the percentage of cases with acute articular rheumatism in these two groups. Of the 14 per cent., 4 per cent. received an additional rating because of rheumatism and 10 per cent. received no additional rating. In the cases which were not rated the last attack occurred a number of years before the date of application—on the average about fifteen years.

The company's standard ratings for mitral regurgitation without a history of rheumatism are as follows:

	Very Best, no Hyp.	Average no Hyp.	With Slight Hyp.	With Moderate Hyp.	With Considerable Hyp.
Mitral regurgitation....	+60	+75	+100	+125	Declined

Old Lung Trouble, Cured Phthisis, Hemoptysis and the Like.

One of the most interesting questions with which we have to deal is the effect upon longevity of consumption or tubercular disease of the lungs. Fragmentary studies of our own, the first of them in 1900, early satisfied us that the relative mortality in these cases is much heavier among the light weights than among those of heavy build; also heavier among young persons than among older lives. These facts are shown in class 55 of the Specialized Mortality Investigation, especially if we apply to the ratios there published the correction necessary to make them express the mortality compared with the true mortality of the contributing companies during the period covered by the investigation. Again, classes 13, 14 and 23 of the Medico-Actuarial give us a still broader view of the subject. Both of these investigations had to do with standard lives, with which the present material may not properly be compared.

This is a study of lives of this sort which have been insured on substandard plans in the manner already described. With regard to applicants for insurance who have had tuberculosis or been suspected of having it either because of a suggestive history or of physical signs, it has been the practice of the Company to keep record of three different types of impairments:

A. Cases presenting abnormal physical signs, such as dullness, suspicious apices, rales, area of consolidation and the like.

B. Cases giving a history of blood spitting or hemoptysis, but without physical signs or definite history of disease.

C. Cases that have frankly suffered from tuberculosis of the lungs and recovered from it.

It was thought that the majority of these cases would fall in the last of these categories, group *C*, or in it in combination with either *A* or *B*. That is to say, we should expect a history of old lung trouble with blood spitting or with physical signs of the disease found on examination. It was found, however, that in only 35 per cent. of our cases was this true; that in 40 per cent. of them there was a history of blood spitting alone and in 25 per cent. some physical signs without any record of actual disease. This result was so surprising that we reviewed the original papers with great care in a number of cases chosen at random to see if our card records were correct. We found no evidence of error, but did find that in some of the cases of hemoptysis or blood spitting there was a record of "a rundown condition" at some time in the past. We also found in some of the cases in group *A* that the applicants had no idea of their condition and in other cases there was a history of only pleurisy, pneumonia or an attack of bronchitis.

We have studied this material in three groups:

(*a*) Physical signs in lungs on examination without a history of tuberculosis.

(*b*) A history of blood spitting without a definite history of tuberculosis.

(*c*) Cured tuberculosis of the lungs with or without either a history of blood spitting or physical signs on examination.

This material was divided into three weight groups as follows:

(1) Underweight—persons 10 per cent. and more underweight.

(2) Average weight—persons from 9 per cent. underweight to 9 per cent. overweight both inclusive.

(3) Overweight—persons 10 per cent. and more overweight.

A study of the material in group (*a*) divided into the three weight groups gave the following:

	No. of Cases.	Actual Deaths.	Expected Deaths by M.A. Table.	Ratio of Actual to Expected.	
				By M.A. Table.	By Co.'s Experience on Standard Risks.
Underweight.....	498	49	23.9	205%	190%
Average weight.....	594	47	26.0	181	165
Overweight.....	173	14	8.3	169	155

These results are in accordance with the expectation that the mortality should be greatest among the underweights.

A study of the material in group (*b*), persons giving a history of blood spitting without a definite record of tuberculosis, showed the following:

HISTORY OF BLOOD SPITTING.

	No. of Cases.	Actual Deaths.	Expected Deaths by M.A. Table.	Ratio of Actual to Expected.	
				By M.A. Table.	By Co.'s Experience on Standard Risks.
Underweight.....	752	95	55.1	172%	160%
Average weight.....	1,219	113	69.1	164	150
Overweight.....	307	25	19.3	130	120

Here again we see the higher mortality of the underweights shading down to the comparatively low mortality among the overweights, but it is to be noticed that the mortality in this group is not as high as it was found to be in Group (*a*).

In the last group (*c*), we included all cases with a history of pulmonary tuberculosis, whether with physical signs or a history of blood spitting or with neither of them.

HISTORY OF CURED PHTHISIS.

	No. of Cases.	Actual Deaths.	Expected Deaths by M.A. Table.	Ratio of Actual to Expected.	
				By M.A. Table.	By Co.'s Experience on Standard. Risks.
Underweight.....	569	41	24.6	166%	155%
Average weight.....	1,045	71	34.1	208	190
Overweight.....	292	15	9.8	153	145

This experience is notable in that the mortality among the underweights is better than that among persons of average weight. Naturally the Company has been very careful in its selection of light weights with a history of tuberculosis and the comparatively low mortality among those underweights may be due to the extremely rigorous selection practiced among them.

In order to get an expression of both the influence of age and of the time elapsed since recovery from the disease, groups (*b*) and (*c*) were combined and subdivided according to age and according to whether the attack was within five years or more than five years of the date of application. A subdivision by weight groups of persons aged at entry 40 and over whose last attack occurred within 5 years prior to application, is not given, as there were only 2 deaths in the underweight and 5 in the overweight group. The following table gives a synopsis of the result:

	Actual Deaths.	Expected Deaths by M.A. Table.	Ratio of Actual to Expected.	
			By M.A. Table.	By Co.'s Experience on Standard Risks.
LAST ATTACK WITHIN 5 YEARS. *Ages 15–39.*				
Underweight	45	13.6	330%	295%
Average weight	73	27.9	262	235
Overweight	11	5.8	188	170
Age 40 and over.				
	17	16.1	106	100
LAST ATTACK OVER 5 YEARS AGO. *Ages 15–39.*				
Underweight	45	26.6	169	155
Average weight	60	36.4	165	150
Overweight	10	9.1	110	100
Age 40 and over.				
Underweight	44	35.7	123	115
Average weight	41	31.6	130	125
Overweight	14	9.0	155	150

This table brings out well the fact that the mortality is exceedingly heavy among young persons only recently recovered from the disease; also that it is comparatively heavy among light weight and medium weight applicants under 40 years of age, even though the last attack occurred more than five years ago. It is interesting to note too that each group shows a mortality substantially higher than normal, excepting where the amount of material is so small as to raise a question of accidental fluctuation. In the overweight group aged 40 and over, last attack over 5 years ago, the fact of overweight may be more significant than the history.

A review of the causes of death in these three groups shows that 35 per cent. of the deaths in group (*a*) was due to tuberculosis, 35 per cent. in group (*b*) and 38 per cent. in group (*c*)—a uniformly high mortality from tuberculosis of the lungs in all three groups. Combining all of the groups and studying them from the standpoint of build, the deaths from tuberculosis of the lungs stood at 42 per cent. among underweights, 36 per cent. among persons of average weight and only 13 per cent. among those in the overweight group.

Influence of Climate.

It is often claimed by those who live in climates or parts of the country specially famed for their salubrity, that tuberculosis among them is a much less formidable disease than it is elsewhere, and that a tubercular process arrested there rarely gives trouble afterwards. To test this out, we set apart the risks in this study which at the time of their acceptance were residing in the eight mountain states, Idaho and Montana on the north to New Mexico and Arizona on the south. There were 264 of these lives with 28 deaths among them, 11 deaths expected by the M.A. table, a ratio of 255 per cent. Of the 28 deaths, 15 were from tubercular disease. While the amount of material is too small to justify any very positive conclusion, it is large enough to suggest that the mortality among persons of this sort living in the so-called mountain states at time of application is apparently not better than among those living in other states at time of application.

The following is the table of numerical ratings which we now employ:

HISTORY OF TUBERCULOSIS OF LUNGS OR OF BLOOD SPITTING.

A. Without Physical Signs of Old Lung Trouble.

Age at Entry.	No. of Years Elapsed Since Attack.*	Percentage Under or Over Weight.				
		−20%	−10%	0	+10%	+20%
25.....	2– 5 yrs.	+260	+175	+125	+ 80	+60
	5–10 "	+170	+115	+ 80	+ 55	+40
	Over 10 "	+ 80	+ 55	+ 40	+ 25	+20
35.....	2– 5 "	+190	+130	+ 90	+ 65	+40
	5–10 "	+125	+ 80	+ 60	+ 40	+30
	Over 10 "	+ 60	+ 40	+ 30	+ 20	+15
45.....	2– 5 "	+ 95	+ 65	+ 45	+ 30	+20
	5–10 "	+ 60	+ 40	+ 30	+ 20	+10
	Over 10 "	+ 30	+ 20	+ 15	+ 10	+ 5

B. With Physical Signs of Old Lung Trouble.

25.....	2– 5 yrs.	+370	+260	+175	+125	+80
	5–10 "	+235	+170	+115	+ 80	+55
	Over 10 "	+130	+ 85	+ 60	+ 40	+30
35.....	2– 5 "	+280	+190	+130	+ 90	+60
	5–10 "	+170	+125	+ 80	+ 60	+40
	Over 10 "	+100	+ 65	+ 45	+ 30	+20
45.....	2– 5 "	+145	+100	+ 65	+ 40	+30
	5–10 "	+ 85	+ 60	+ 40	+ 30	+20
	Over 10 "	+ 50	+ 35	+ 25	+ 20	+10

* We do not accept cases where the applicant gives a history of tuberculosis of lungs or blood spitting with the last attack within two years of application.

In the practical application of these ratios to current business we apply them to tubercular disease of the lungs as a whole, including a simple history of hemoptysis, not clearly traumatic, or lung signs without any history, on the one hand, and a history of consumption with old lung signs, on the other. As in all numerical ratios these are central values and the ratings in individual cases should be shaded from these according to the merits of the case. This is where a discriminating medical judgment is most useful.

Discussion of Preceding Paper.

(written discussion.)

MR. MERVYN DAVIS:

The Society is under renewed obligations to Mr. Hunter and Dr. Rogers for the additional study now presented of the mortality on impaired lives insured under certain sub-standard forms of policy.

Many of the classes covered in a study of this character must of necessity be small, even in the case of a company doing a comparatively large sub-standard business; the results of the experience of any one company in such a class must, therefore, not only be affected by the standard of selection exercised and the ratings imposed by the company in question, but would also be subject to comparatively large accidental fluctuations. It would seem highly desirable, therefore, to have the results of such studies supplemented and confirmed, when possible, by similar investigations of the experience of other companies.

With this thought in mind I am submitting the results of an investigation of the Equitable into the first of the classes covered in this paper.

The investigation submitted was made on the basis of policies and covers the issues of 1900 to 1918 inclusive, observed to 1919 anniversaries. The expected claims used in obtaining mortality ratios were determined by the Equitable Standard Table, a select table based on the standard experience of the Equitable in the Northern States from 1899 to 1909 which has been found to represent fairly closely the experience for the following ten-year period.

Class I. Sub-standard Policies with a History of Inflammatory Rheumatism, but No Other, Except Minor, Impairments.—This class covers 560 policies with 29 claims, the ratio of actual to expected claims being 134 per cent. Making due allowance for the possibilities of accidental fluctuations, this result would appear to agree closely with that found in the New York Life experience. The class is too small to permit a subdivision according to the number of attacks or their incidence.

Class II. Mitral Regurgitation with and without Hypertrophy, with History of Inflammatory Rheumatism.—This class covers 405 policies with 34 claims and shows a mortality ratio of 429 per cent. It was found that the 34 policy claims covered only 26 deaths, and an investigation was accordingly made on the basis of lives, which produced a mortality ratio of 381 per cent. Even this lower ratio compares unfavorably with that found from the New York Life experience, though it would appear to confirm Mr. Hunter's conclusion as to the ratings required for this combination of impairments.

The authors of the paper note apparent inconsistencies in the inflammatory rheumatism group while similar inconsistencies may be observed in some of the lung disease groups. Similar inconsistencies are found in the Equitable's experience on risks with mitral regurgitation, which it is felt may be of sufficient interest to warrant inclusion in this discussion. The experience, exclusive of that given under Class II above, is shown in the three following classes:

Class III—Without Hypertrophy or Other, Except Minor, Impairments.

Entrants.	Claims.	Ratio of Actual to Expected
2208	119	159%

Class IV—With Hypertrophy but No Other, Except Minor, Impairments.

1952	72	217%

Class V—With and Without Hypertrophy and With Other Important Impairments.

1130	49	155%

The reasons for the inconsistency found in the ratios for these three classes are undoubtedly the same as those advanced by the authors of the paper for the inconsistencies noted by them; that is, the inconsistency is due partly, perhaps, to accidental fluctuations and partly to the fact that where another important impairment was found, the degree of either the heart lesion or of the other impairment, or of both, was, in general, less than the average.

These considerations indicate that the results of the experience of any one company on a given class of impaired risks must be viewed with considerable caution by any other company which proposes to base its ratings for the given impairment on those results. In the first place, the class will generally be a small one, and the results, therefore, are subject to accidental fluctuations, which may be expected to be much more pronounced in an experience by policies than in one by lives. In the second place, the degree of selection exercised and the ratings imposed by the original company and its general practice in the matter of the issue of sub-standard policies, will all have an effect on the experience. Varying degrees of impairment will be covered and the proportions in which the different degrees of impairment will be found will vary as between different companies, or even from time to time in the same company, in the event of material changes in the severity of selection. As an example of the effect of the general practice of the company, it is evident that in the case of an impairment under which a heavy mortality may be expected, a company which limits the issue of sub-standard policies to cases call-

ing for ratings for not more than 75 per cent. or 100 per cent. will, in general, show a lower mortality ratio than one which issues policies up to 150 per cent. or 200 per cent. extra ratings.

When the Equitable began to issue sub-standard policies it was believed that the extra mortality under mitral regurgitant murmurs would be deferred rather than immediate. This expectation has not been realized and the experience quoted above seems to indicate clearly that the ratio of actual to expected claims is just as high in the earlier as in the later policy years. It would be interesting to know if there are any similar indications as to the incidence by policy years of the extra mortality in the New York Life experience under the lung disease groups.

It will also be interesting to learn to what extent this experience has been affected by claims due to the War and to the Influenza Epidemic of 1918 and 1919. In the Equitable experience given above the proportion of claims due to these causes was slightly higher than under the general standard experience. In view of the high average age of entry under the classes covered, this result is contrary to what would be expected and is, apparently, due to accidental fluctuations.

MR. F. H. JOHNSTON:

We are again indebted to Mr. Hunter and Dr. Rogers for valuable information concerning the treatment of specific impairments. The treatment of under average or impaired lives is anything but an exact science, and the best we can hope to do is to keep within reasonable limits, so that anything along the line of actual experience is particularly valuable.

With regard to cases showing a history of inflammatory rheumatism the authors draw attention to the fact that those with a record of an attack of ordinary severity were usually given standard policies, but for the purpose of their investigation the attacks of rheumatism must have been sufficiently severe to call for some rating. This leaves some ground for discrimination as to where the "ordinary severity" ceases and the "sufficiently severe" begins.

The results under the class "Rheumatism and Mitral Regurgitation" are extremely significant, especially in those cases where there is a moderate amount of hypertrophy. The authors properly caution those who employ the Numerical method of valuation that the hazard involved in "Mitral Regurgitation with a history of Acute Articular Rheumatism" is much greater than the sum of the separate ratings. They gave a table of their company's standard ratings for mitral regurgitation without a history of rheumatism, and in view of their cautionary remarks it would be interesting to know what ratings they would advocate for mitral regurgitation *with* a history of rheumatism.

A further valuable addition of their experience with regard to the various forms of lung trouble is very instructive and helpful.

The table giving an analysis by "build" of groups (*b*) and (*c*) combined are especially interesting. In the age group 15 to 19 with the "Last Attack Within Five Years" the results are about what would be anticipated; that is, the under-weights show decidedly the heaviest mortality, and the average-weights (though less unfavorable) are also very bad risks. On combining the three "build" groups without regard to age, however, it is found that the average-weight group shows the heaviest mortality, being 181 per cent. of the expected, as against 177 per cent. in the case of under-weights. In the average-weight group, however, there is a smaller proportion of deaths from tuberculosis, so that the higher ratio of actual to expected must be due to some other cause.

While the results under the heading of "Influence of Climate," as pointed out by the authors, were based on an amount of material too small to justify any very positive conclusion they are somewhat surprising. The results may possibly be explained by the tendency of persons either afflicted with tuberculosis or in fear of it migrating to such localities as were considered particularly salubrious.

In handling sub-standard business there is one practical feature which must always be borne in mind, and that is the tendency to ultimately remove from any particular class those who have either shown improvement or who have recovered, as far as can be ascertained, from the impairment for which they were rated. Even though an effort is made on the part of the companies to refrain from making changes in classifications after policies have been issued, a great deal of pressure will be brought to bear upon the companies by the agents to modify or remove a rating where the policyholder has been subsequently accepted at a more favorable rating. Too liberal a practice in this respect would in the long run leave a residue of more than ordinarily bad risks in the rated classes. I take it, however, that in the method followed by Mr. Hunter and Dr. Rogers in preparing the data for their paper this feature has been largely minimized by the length of time over which their observations were extended.

(ORAL DISCUSSION.)

MR. FRANKLIN B. MEAD:

The New York Life's present experience on heart murmurs in connection with rheumatism bears out its experience which the authors of the present paper presented three years ago which rather startled us as to its seriousness. However, in order that we may more accurately judge as to the true import and meaning of this experience it seems to me that we should have more definite information as to the connotation of the term "rheumatism" as used in this experience: How long a period is to elapse before

a serious attack of rheumatism in connection with heart murmur is disregarded; how long before a moderate attack is disregarded? As a matter of fact, in order to better understand the significance of the increased mortality on cases with a history of acute articular rheumatism without heart murmur which were granted sub-standard insurance by the New York Life, it would be very valuable to know what their mortality experience has been upon applicants with a history of rheumatism which were accepted by them as standard and, too, in order to fully interpret this, some outline should be given as to the type of cases which were accepted as standard and the type of cases which were accepted as sub-standard.

In our own company for our own purposes of selection we are, in connection with heart murmurs, ruling out serious rheumatism occurring five years prior to the time the case is brought to our attention and after three years we disregard a moderate attack of rheumatism.

The experience of the New York Life in this direction is developing some very interesting ideas as to the import of heart murmurs and, more particularly, the influence of infections, causing heart murmurs, more or less removed from the time of observation, at the time of selection. It seems to me it will ultimately develop that heart murmur cases are of two types: those associated with either acute or chronic infection together with some circulatory disturbance, or such infection implied by a recent manifestation of infection such as the rheumatic history we have before us for present discussion: and, again, those in which the focus of infection has either been removed or disappeared, or, so far as life insurance purposes are concerned, appears to have been removed or disappeared.

In this connection it is interesting to note that rheumatism is only one form of infection which causes circulatory disturbance and it is quite likely that we should consider other types in just the same light as we do this infection which, as a manifestation, we term "acute articular rheumatism." The circulatory disturbances and the recent history of infection seem to be the practical marks by which we, as underwriters, may determine whether the probability is that the infection is still a matter of influence. And it seems that there is another important group: where heart murmur occurs after age forty without apparent cause. It is quite probable that the most of these are due to myocardial degeneration and are, therefore, a more serious type than a heart murmur which occurs from an acute infection, especially where this infection has probably disappeared.

Another type of infection first came to my attention some time ago and upon some little investigation it seems to me it must be seriously regarded. It appeared originally in the case of an applicant in the thirties who applied to us for insurance in the spring

of 1921. The feature in the case was a simple mitral regurgitation without hypertrophy which caused us to give a rating of 175 per cent. However, there was one feature that we did not then consider significant which I believe must be reckoned with. It was stated in the papers that the heart murmur was the result of influenza in 1919. Did we not here have a source of recent infection which was just as serious, and possibly even more serious, than that evidenced by an attack of rheumatism? This applicant died within a year of cerebral embolism, this indicating to my mind that a recent infection, such as that of influenza causing heart murmur, is at least just as serious as one resulting from a similar history of rheumatism. Since noticing the first claim of this type I have noticed two or three other early death claims from circulatory degeneration upon those who had, upon examination, heart murmur without complications but resulting from influenza during the past two or three years.

Another case came under my observation showing the progressiveness of certain types of circulatory disturbances. About three years ago we accepted a young man in Chicago for $5,000 with our minimum heart murmur rating for mitral regurgitation. We received a statement that he had been under observation by one of the very best specialists on heart murmur in the country. This specialist had made the comment that the heart murmur was merely a technical one and that he considered that it would have no serious effect upon the applicant's after lifetime or upon his health. Right here attention might be called to the difference between the clinical point of view and the underwriting point of view. An extra mortality of five or ten in a thousand does not seriously disturb the clinician. In other words, such extra mortality would not be apparent to him but from the underwriter's point of view it is clear that such an extra mortality increases our mortality on insured risks from one-half to double, which is of serious financial moment to an insurance company. But to revert to this applicant; a year later he was examined for additional insurance and it was found that the heart murmur had slightly progressed. Here I believe we should have taken warning. This, to my mind, was an indication of progressive, existing infection. However, we overlooked the warning and issued the policy at a slightly higher rating, which it seems to me was an improper viewpoint in view of the apparent progression. The policy was, unfortunately, delivered, with great protestation on the part of the applicant and agent. At this time, too, there was another feature to which, at the time, we did not attach sufficient importance. Perhaps we even overlooked it and to this, our subsequent studies have developed, we should have given serious attention. That is, there was a reduced blood pressure, both systolic and diastolic. It seems to me that reduced blood pressure, in view of our observation, even if the pulse pressure is normal and much more so if the pulse pressure

is abnormal, in connection with heart murmurs, is an indication of the beginning, at least, of myocardial change, thus indicating serious hazard. A short time ago this applicant appeared at our office for reexamination for the purpose of securing reduction in rating. The results of this examination were astounding. We found a man comparatively young with unquestioned evidence of myocardial change and degeneration. He now appeared with a double murmur which was diagnosed aortic regurgitation and aortic stenosis. His blood pressure was still further reduced. In fact our diagnostician was unable to detect any diastolic whatever, *i.e.*, it was zero, and there was evidence of other serious circulatory disturbances. Upon more closely investigating the case the conclusion was reached that he was probably suffering from syphilitic infection. We should have taken warning at the time our second examination was made.

There is another type illustrating the serious import of circulatory infections which we have under consideration in the present discussion. Yesterday I was in the office of a New York company and we were discussing the significance of these infections as well as the significance of lowered blood pressure as above referred to. Much interest was manifested in the subject by the Medical Director and the Actuary. Later we went out to luncheon and upon our return we found that the Actuary of the company had just sent down a current death claim which illustrates the principle we have just been discussing. The insurance was upon a young man who had been accepted in September, 1920, for $1,000 on a rating of 137½ per cent. for the reason that in 1919 he had had a slight attack of tonsilitis lasting just a few days and later in the year had had a severe attack of acute articular rheumatism lasting three weeks. In the examination his blood pressure was 116 systolic and 64 diastolic. He had, as you will note, a very low diastolic with a very high pulse pressure, significant of some circulatory disturbance. The rating itself was a rather severe one for the attack of rheumatism but some allowance had been made for the blood pressure which is unquestionably right in view of the observations we have been making at our own office. This boy of eighteen had just died of myocardial degeneration, which illustrates the point we have been discussing.

About five years ago, after having done an increasing sub-standard business for five years previously, we began to install the Hollerith System, in connection with which we prepared a mortality card, both for standard and sub-standard business. We had the benefit at that time of the mortality cards of all of the leading companies, not only those doing a sub-standard business, but those doing a standard business only, and we had the benefit of the cards which had been used in the Medico-Actuarial and other general investigations. As a result we adopted what we considered a very complete and comprehensive card even for sub-standard insurance,

but for some time we have been realizing the imperfections and the inadequateness of this card and great and unsolved difficulties involved in classification of risks, particularly in connection with heart murmur and urinary impairments, but this is true of other types of medical impairments. Daily we see increasing difficulties in these directions. In order to determine the sufficiency of our method of coding, the adequacy of our cards, as well as the general trend of our sub-standard mortality, which we can at least do as regards degree of impairment or rating, we are beginning to compile our mortality statistics on our sub-standard business. We find at the outset that it will probably be necessary for us to have skilled reviewers not only review the cases involved but compare the resulting coding and the resulting classifications in order to make the most of our statistics as well as to learn more about the proper classification of risks and improve our underwriting methods which we find we must constantly revise in view of added daily experience. In the light of this experience and the difficulties which we see ahead of getting the most out of our data for future guidance as well as taking advantage of the situation to make the greatest possible improvement in our underwriting, it seems to me to be a wise course if those in the Society who are similarly situated or some committee of the Society would look into this matter with a view to determining the best type of cards to be used for the benefit of not only those who are doing a sub-standard business but those who are now just entering that field or who will in the near future do so.

The question of classification is also an important matter to be taken up in this connection in the light of our experience. It is quite probable that a special card for urinary impairments will be required as well as a special card for heart murmurs in view of the many influencing factors in connection with these types of impairments. For instance, the very beginning of our present investigation indicates that the bulk of our claims in connection with heart murmurs are upon risks which have certain complicating features which were not recognized at the time we accepted them as being influencing factors in mortality. We now know that they must be influencing and our companies in general should be placed in a position to study these facts to the best advantage as well as to have a common understanding as to what constitutes homogeneity of data. I cannot too earnestly urge that this question be taken up by the Society or under the auspices of the Society.

MR. T. B. MACAULAY:

I was very interested in the combination of heart murmur and low blood pressure. A couple of days ago one of our agents wrote me about two cases that he thought had been severely treated by our Medical Department.

One of them was a very peculiar case. The man had a record of eight different reports of heart murmur, the last three or four having been with hypertrophy. After that came a number of records—no heart murmur found. He was examined by our Chief Medical Officer, who found a functional murmur sometimes there, sometimes not. There was a fairly high pulse (85). He was rather thin, and there were slight indications of goitre. My interpretation of those facts was that there was some infection which was the cause of everything. We know that when there is an infection nature tries to overcome it by increased activity of the thyroid gland, which, of course, is the goitre gland. Here we had clear indications of that. The goitre indicated increased activity of the thyroid. Where such increased activity is very pronounced, as in exophthalmic goitre, there is low blood pressure, rapid pulse, gradual wasting and protruding eyeballs. This case appeared to be of the same nature, though of much less severity. Here we had low blood pressure, high pulse rate, and evidence of over-activity of the thyroid, all apparently indicating the presence of some infection which was also the cause of the heart trouble, even though that were but temporary. That was at least my interpretation of the symptoms. We could not possibly treat that man as an average risk.

I think that whenever you get a case of heart trouble and low blood pressure, especially if accompanied by a pulse rate more or less beyond the average, and still more if you have any indication of thyroid activity, you may put all down as due to some persistent infection, which would rule the man out from first-class lives.

(AUTHOR'S REVIEW OF DISCUSSION.)

MR. ARTHUR HUNTER:

I was in favor of the change from the old method of discussing papers at the ensuing meeting to the new one of discussing papers at the same meeting at which they are presented. I am afraid, however, that we are not getting as fruitful discussions as under the old method. If the papers are received two weeks, or even *six* weeks ahead of the meeting, it is difficult to find time to make investigations or prepare data which would be of value. The paper by Dr. Rogers and myself is one in point. I have no doubt that the experience of other companies could have been given if there had been time to prepare the necessary mortality investigations.

It is comforting to learn that the Equitable has had a higher relative mortality than the New York Life in cases of inflammatory rheumatism with heart murmur. The high mortality with this combination of impairments has resulted in a great deal of discussion among our medical men. They were inclined to ques-

tion our results, but the confirmation of our experience by that of the Equitable seems to put beyond doubt the high mortality among persons with heart disease who have had inflammatory rheumatism of a more or less severe nature. As a layman, it seems to me that either the mitral regurgitation, which is probably the result of inflammatory rheumatism, is of a severe type, or that among the cases of mitral regurgitation without a history of rheumatism there were many in the nature of functional disturbances.

Referring to the suggestion by Mr. Davis that additional information might be given with regard to the incidence of mortality by policy years, we found, after the first few years had elapsed, a decreasing ratio of actual to expected deaths by policy years in the case of mitral regurgitation. The decrease in the corresponding ratio was even more rapid in the case of our insured with a history of tuberculosis of the lungs or of blood spitting.

The experience of the Equitable with regard to mitral regurgitation *without* a history of inflammatory rheumatism was more favorable than that of the New York Life in cases without hypertrophy, and practically the same in cases with hypertrophy. The more favorable experience under the former may be due to the fact that the Equitable only provided for from 40 per cent. to 50 per cent. extra mortality in the early years of granting such policies, and probably therefore made a more severe selection than we did.

I am sympathetic toward some of the things which were stated by Mr. Mead, but do not believe that we should make too great refinements as a small amount of our business only can be examined by specialists. Furthermore, there is a practical difficulty which we have to face in dealing with heart murmurs,—namely a difference of opinion between men of equal ability. It is not unusual for a man to come to our Home Office for a review of his case, on the ground that two medical examiners of a competing company had not found the heart murmur which our medical examiners had found.

I had hoped that some one would give an explanation of the distribution of the cases in the three groups of lung trouble. The distribution among the three groups was not expected by us, and so far I have not been able to obtain an entirely satisfactory explanation.

With regard to the question raised by Mr. Johnston, on the effect of taking first-class risks out of the underaverage class, I should like to state our method. Practically all statistics used in determining the advance in age were based on our experience on policies under which the company allowed three years in which to remove the lien or take the policy out of the sub-standard class. A provision was therefore made for granting better terms to the policyholder within a limited period.

Personal Accident and Health Insurance.

BY

JOHN M. LAIRD.

Personal Accident and Health insurance in the United States comprises:

I. Commercial Accident and Health insurance introduced in 1864 and successfully developed by "Accident" companies,

II. Non-Cancellable Accident and Health insurance introduced in 1915 and still in its infancy,

III. Accident and Health benefits with Life insurance—permanent total disability introduced in 1896 and accidental death in 1904.

I. COMMERCIAL ACCIDENT AND HEALTH INSURANCE.

A. Accident Insurance.

Commercial Accident insurance as distinct from Health insurance covers:

1. Accidental Death—loss of life.
2. Dismemberment—loss of limb or sight.
3. Disability—loss of time.
4. Surgical and Hospital Fees.

The loss must, however, arise "from bodily injuries effected directly and independently of all other causes through accidental means, suicide (sane or insane) not included."

What is "Accidental Death"?

An "accident" has been generally defined as "an event that takes place without one's foresight or expectation; an undesigned, sudden and unexpected event, chance, contingency." Although by "accidental death" we usually mean death caused by some such means as an automobile wreck, still the definition of accident is so broad that a death caused by disease might be construed as

"accidental," particularly if the disease is infectious or contagious as in the case of typhoid fever or smallpox. In fact, under the broadest definition of accidental deaths might be included all deaths except those due to senility or suicide.

As the death benefit under Accident policies is sold at a low premium as a limited form of coverage applying to only a fraction of the total number of deaths, it is necessary that the policy language should clearly indicate the extent of the coverage. After years of experience practically all companies have adopted uniform language which gives insurance not against accidental death but against death effected by accidental means. A distinction is drawn between the *result* and the *means*. Even with this more or less standardized definition there are borderline cases which sometimes lead to litigation and unfortunately even the Courts have not always appreciated the distinction.

To establish liability it must be shown that an injury occurred and that the injury was caused by accidental means. For instance, in one case the Insured was swinging Indian clubs and as a consequence ruptured a blood vessel. The injury was of course accidental but to ascertain whether the injury was caused by accidental means it was necessary to determine whether the Insured did something that he did not intend to do. If for instance the clubs slipped in his hands or struck the chandelier, then the necessary element of accidental means would be present but if he accomplished his exercise in precisely the way intended without the intervention of a fortuitous circumstance, the injury could not be considered as effected by accidental means and therefore the Company would not be liable.

In some policies the expression is "through accidental means"; in others "through external, violent and accidental means." But according to Court decisions the adjectives "external" and "violent" are of little importance in determining liability. For instance, it has been held that the Company is liable if the Insured has accidentally inhaled gas or water into the lungs, come in contact with poisonous substances, choked on a piece of meat, swallowed a fish bone, or succumbed to nervous shock consequent upon fright.

After it has been shown that the Insured received an injury caused by accidental means, it must also be established that this injury was the *sole cause* of death. If an injury effected by accidental

means brings about a disease which in turn causes death, the claim is valid. If for instance the Insured receives a severe blow on the chest and this blow brings about pneumonia which results in death, the Company is liable. The injury is regarded as the sole cause of death if it is the sole original cause of any connected chain of events bringing about death even though the final link may be a disorder which would commonly be considered a disease.

Furthermore, even though the Insured at the time of receiving an injury is suffering from an incurable disease which would inevitably cause his death within a relatively short period, the Company is liable if the injury is sufficiently severe to cause death independently of the disease; if, for instance, he is struck by lightning or accidentally killed by a bullet.

Sometimes, however, a trivial accident merely *accelerates* the death of a person already seriously ill. In Legal Notes, *T. A. S. A.*, XXI, 230, the Insured tripped and fell twice in going from the cellar to his room, and died the same evening. An autopsy revealed heart and lung lesions and the testimony of physicians was that at most the falls merely aggravated and made fatal an already existing chronic disease. The Court held that the Company was not liable.

An injury cannot be considered to be the sole cause of death if any disease, bodily infirmity or abnormality existing at the time the injury is received *co-operates* with the injury as one of the causes of death. Thus, if a man suffering from diabetes receives an injury which would not be sufficient to cause serious consequences to a normal individual and dies as a result of the two factors, injury and pre-existing disease, there is no liability.

A difficult question arises when the injury brings about a *recurrence* of a disease from which the Insured had previously suffered but apparently entirely recovered. Under the weight of authority there is liability if the evidence justifies the conclusion that the injury was the sole cause of rendering active and virulent a mere dormant susceptibility or constitutional tendency.

Practically all policies exclude death by *suicide* whether sane or insane. Strictly speaking, the burden of proof rests upon the claimant to show that death was caused by accidental means other than suicide. It is important however for the Company to establish a motive for suicide in order to offset the presumption against

suicide "based on the well-nigh universal human characteristic of love of life and fear of death."

In Legal Notes, *T. A. S. A.*, XX, 457, the Court in effect says:

"When there is no convincing evidence for or against suicide, a finding in favor of accidental death will be upheld. The evidence for or against the fact may be either direct or circumstantial. If the evidence in favor of suicide is wholly circumstantial, then it ought to be such and of such weight as to negative every reasonable inference of death by accident."

In some cases death may *appear* to be due to accidental means but may actually be due to disease. For instance, a man who has been alone in a boat is later found in the water dead. Death may have been due to suicide, accidental drowning or heart failure. If it can be shown that he was previously suffering from heart trouble and if an autopsy reveals that the lungs are practically free from water, it will be difficult for the claimant to prove that death was due to accidental means. A similar case arises where death is caused by a fall and the fall may in turn have been due to dizziness or fainting.

Frequently an *autopsy* is of great value in determining the cause of death and most Accident policies provide that the Company shall have the right and opportunity to make an autopsy. Iowa, however, refuses to approve a policy containing such a provision.

Under the Accidental Death provision most claims can readily be settled without controversy but in borderline cases it is important to keep in mind the general trend of Court decisions and to guard against any broadening of the policy language or of its interpretation which might gradually lead to extending the coverage to include a large proportion of deaths which should be construed as due to disease and not due solely to accidental injuries.

Dismemberment.

If the policy provides a "principal sum" for death by accidental means, it usually stipulates that for loss of limb or sight a definite proportion of this principal sum will be paid as follows:

	Per Cent.
Both hands, or both feet, or one hand and one foot, or sight of both eyes, or one hand or foot and sight of one eye	**100**
One hand or one foot	**50**
Sight of one eye	33⅓
Thumb and index finger	**25**

If more than one such loss results from injuries in one accident, the Company pays the largest benefit provided for any one of the losses so sustained but does not pay for the other losses. Payment under this provision terminates the policy, without additional payments for disability.

Disability.

In Accident insurance *Total Disability* is defined as inability to perform "any and every kind of duty pertaining to *his* occupation." If for instance a dentist suffers an injury to his right arm and is thereby prevented from engaging in his regular profession, he is entitled to benefits. Strictly speaking, this disability must be caused by injuries due to accidental means just as in the case of the Accidental Death benefit, but companies have frequently paid for disability caused by accidental injuries even though the injuries were not due to accidental means. This liberal interpretation of the Disability provision eliminates controversy with the Insured and does not materially increase the payments as there is apparently no danger that this course will lead to a gradual extension of the coverage to include disability due to disease. It is felt that mere disability due to disease cannot be construed as accidental although death due to disease might be so interpreted.

Partial Disability is defined as inability to perform "one or more important daily duties pertaining to his occupation."

Usually the Accident policy provides full weekly indemnity for total disability as long as it continues and 50 per cent. of this amount for partial disability up to a limit of 26 weeks. Under some contracts the benefits for partial disability are 75, 50 or 25 per cent. of the full indemnity according to the degree of partial disability but this provision makes claim settlements more difficult.

For certain injuries the Insured may take in lieu of weekly indemnity for the period of disability an "optional indemnity," that is, a definite lump sum stated in the policy. For instance, for complete dislocation of the hip he may take a lump sum equivalent to weekly indemnity for twelve weeks, the average period of disability for such an injury. In order to avoid selection against the Company, this optional indemnity must be chosen within twenty days from the date of the accident.

Surgical and Hospital Fees.

If the injury necessitates a surgical operation, the Company pays a definite sum in addition to any other benefits; for instance, amputation of the arm or leg—200 per cent. of one week's indemnity.

If the injury does not result in death or disability but requires surgical treatment, the Company pays the amount actually expended for such treatment but not exceeding one week's indemnity.

If the Insured is entitled to weekly indemnity and is removed to a hospital, the Company usually pays 50 per cent. additional weekly indemnity for the period during which he is in the hospital but not exceeding twenty consecutive weeks.

Double Indemnity.

For certain favored accidents the major benefits are doubled, tripled or even quadrupled—for instance, "if the injuries are sustained while a passenger in or on a public conveyance." Sometimes for an extra premium these additional benefits are paid if the injuries are sustained while riding in a private conveyance, such as an automobile.

Classification of Occupation.

Occupation has a most important bearing on the claims to be expected under an Accident policy. The Bureau of Personal Accident and Health Underwriters has classified more than 3,000 different occupations as follows:

Number	Classification	Rating, Per Cent.
1	Select and Preferred	100
2	Extra Preferred	120
3	Ordinary	170
4	Medium	200
5	Special	250
6	Hazardous	300
7	Extra Hazardous	400
8	Perilous	500
9	Extra Perilous	600

Standard policies are issued to risks classified as Select and Preferred, Extra Preferred or Ordinary, but not to risks with a more unfavorable rating. Less liberal policies are issued to industrial risks with as high a classification as Extra Hazardous.

The higher ratings are assigned chiefly for the purpose of determining pro rata the amount payable in case of a claim after the Insured has changed his occupation. If for instance a Select risk later changes his occupation to Medium, any subsequent claim is adjusted on the basis of 50 per cent. of the amount he would have received under the Select classification.

The classifications are presumably based on actual experience supplemented by the best underwriting judgment. The claim payments have probably been apportioned roughly as follows:

Single principal sum for death	32%	
Additional sum for death under Double Indemnity	8	
Total death benefit		40%
First 2 weeks of total disability	15	
3rd to 13th week of total disability	10	
Total disability after 13 weeks	5	
Total for total disability		30
Partial disability		20
Dismemberment	4	
Optional indemnity	3	
Surgical and hospital fees	3	
Total for miscellaneous benefits		10
Grand Total		100%

A high occupational rating may therefore be due to a high death rate or to a high rate of disability. If it is caused by a high rate of disability, it may be occasioned chiefly by trivial injuries of short duration or by an abnormal number of more serious injuries causing prolonged disability. Perhaps some day the Classification Manual will show one rating for the death benefit and another for disability, or one rating for the death benefit and long disabilities and another for short disabilities.

Of the total claims only 5 per cent. are due to payments for total disability after thirteen weeks and therefore these occupational ratings may not have much bearing on the premium to be charged for a policy covering total disability with a three months' waiting period. The number of cases of prolonged disability may more closely resemble the rate of accidental death than the rate of trivial injuries of short duration.

In order to illustrate the various factors causing a high rating, let us consider a few typical occupations in each classification.

1. Select and preferred—100 per cent.
   - Bank officer.
   - Clerk in book store.
   - Lawyer.
2. Extra Preferred—120 per cent.
   - Dentist.
   - Music teacher.
   - Oculist.
   - Physician in general practice.
3. Ordinary—170 per cent.
   - Barber.
   - Egg candler.
   - Felt maker.
   - Fish warden.
   - Tool manufacturer, superintending only.
   - Watchmaker.
4. Medium—200 per cent.
   - Adding machine maker.
   - Automatic sprinkler installer.
   - Automobile dealer, demonstrating and repairing but not racing.
   - Pipe fitter.
   - Turkish bath attendant.
5. Special—250 per cent.
   - Bricklayer.
   - Farmer, supervising only.
   - Machinist.
   - Mason.
   - Telegraph or telephone lineman.
   - Tool maker (sharpener).
6. Hazardous—300 per cent.
   - Agricultural implements maker.
   - Automobile driver, heavy delivery car or truck.
   - Axe maker or grinder.
   - Carpenter, shopwork using machinery.
   - Oiler, stationary engineer.
   - Sheep-herder.
7. Extra Hazardous—400 per cent.
   - Cowboy on ranch.
   - Horse driver in races, not jockey.

Farm laborer or farm hand.
Fire works exhibitor.

8. Perilous—500 per cent (Not Insurable).
   Lumberman in woods—hewer, logger, chopper, or sawyer.
9. Extra Perilous—600 per cent. (Not Insurable).
   Cartridge and percussion cap maker.
   Chemist, manufacturing acids or explosives.
   Animal trainer or attendant in circus.

A dentist is rated 120 per cent. because even a trivial injury to the arm, hand or fingers may prevent him from working at his regular profession. A physician in general practice, also rated 120 per cent. is subject to an extra hazard on account of the constant use of the automobile. Furthermore, his irregular hours may cause a run-down condition of such a nature that even a trivial injury will cause a long period of disability. In both professions there is an extra hazard from exposure to septic infection and in Accident policies issued to dentists and doctors septicemia is specifically covered.

A watchmaker rated 170 per cent. on account of the nature of his work is subject to eye strain which may be aggravated by a trivial accident. A telegraph or telephone lineman is rated 250 per cent. chiefly because of the high rate of accidental death and serious injuries. A carpenter using machinery in shopwork is rated 300 per cent. because of frequent injuries causing short periods of disability.

If the occupation is incorrectly stated in the application, and when a claim occurs it develops that the Insured should have been put in a classification calling for a higher premium, the claim payments must be reduced in accordance with the prorate provision. It is therefore important that the occupation and exact duties should be given accurately and minutely. For instance, an employee in a boot and shoe factory may vary from designer classified "Preferred 100 per cent." to leather splitter classified "Special 250 per cent."

B. Health Insurance.

Commercial Health insurance as distinct from Accident insurance covers:

1. Disability—loss of time.
2. Surgical and hospital fees.

The loss must arise from "sickness or disease."

Disability.

Under some contracts full weekly indemnity is paid for total disability while confined to the house and 50 per cent. for total disability while not confined to the house, provided it follows a period of confinement. Benefits will not however be paid for more than 52 weeks. Other contracts introduced a few years ago pay full weekly indemnity for total disability up to a limit of 52 weeks whether confined to the house or not confined.

Occasionally a policy is issued at an extra premium with a special provision that indemnity will be paid as long as total disability continues.

Some policies grant 50 per cent. of the weekly indemnity for partial disability up to a limit of 26 weeks.

As Health insurance has frequently been unprofitable, companies are eager to issue Accident insurance without Health insurance, but usually refuse to issue Health insurance unless the applicant carries an equal amount of weekly indemnity under an Accident policy. Furthermore, Health insurance is now issued only at an annual premium as, with premiums on a semi-annual or quarterly basis, policyholders have a tendency to carry the protection during the winter when the rate of sickness is high and drop the insurance during the summer when the rate is low.

Unlike Accident insurance, Health insurance is issued at the same rate for all occupations from Select to Ordinary inclusive. It is felt that a civil engineer, for instance, will show a much higher rate of disability from accident than a banker but that he will not be subject to much more disability from sickness. Less liberal Health policies are issued to industrial risks with as high a classification as Extra Hazardous.

To avoid selection against the Company, Health policies exclude any sickness beginning during the first fifteen days after the contract is issued.

Practically all the experience now available has been based on Health policies limiting coverage to 52 weeks. The claim payments have been distributed approximately as follows:

First 2 weeks of total disability confined	32%	
3rd to 13th week of total disability confined	28	
14th to 52nd week of total disability confined	10	
Total for total disability confined		70%
Total for disability not confined		15
Surgical and hospital fees		15
Grand Total		100%

Only 10 per cent. of this experience is on total disability excluding the first thirteen weeks and no experience is available for payments beyond the 52d week.

C. Commercial Underwriting.

Commercial Accident and Health insurance is usually issued, without medical examination, for a term of twelve months with privilege of renewal provided the risk apparently remains unimpaired. Accident insurance but not Health insurance may also be issued for three or six months at a proportionate rate without any extra charge for trouble and loss of interest. The age limits in one representative Company are:

Accident Insurance.

Men ages at issue 18 to 65 with renewal to age 70.
Women ages at issue 18 to 50 with renewal to age 60.

Health Insurance.

Men ages at issue 18 to 55 with renewal to age 60.
Women ages at issue 18 to 50 with renewal to age 55.

Accident insurance is issued and renewed at a flat rate regardless of age.

Health insurance is issued and renewed at a flat rate for attained ages 18 to 50 and with a higher flat rate for attained ages 51 and over. If a person enters before age 51, his rate is increased when he reaches age 51.

The Company may at any renewal date refuse to continue the insurance and may at any time cancel the policy by written notice and refund of the unearned premium. The Company is of course liable for any claim originating before the date of cancellation or of refusal to renew. The rate of cancellation and non-renewal is probably from one to two per cent. each year on Health insurance and from one-half to one per cent. on Accident insurance.

The principal reasons for cancellation are:

1. Misstatement in original application.
2. Impaired physical condition.
3. Material reduction in earnings.
4. Repeated claims for recurrent injuries or disease.
5. Unsatisfactory moral hazard.

The cancellation privilege has undoubtedly saved the companies

many prolonged claims, particularly at the older ages. For instance, if it is known that the Insured has diseased kidneys or arteries, the Company cancels his Accident insurance because even a slight injury under these conditions might cause prolonged disability. More frequently one or two short sickness claims indicate a general weakening of the system likely to be followed by a later claim for a prolonged illness.

Unfortunately Commercial policies are subject to heavy lapses, the rate of discontinuance each year being approximately 20 per cent. of the amount in force. The reasons are:

1. The protection is frequently taken as a temporary sporting proposition,
2. The Insured has little equity in the policy and can usually replace the insurance in another company without medical examination and without increase in premium,
3. The salesman generally considers that he has a vested interest in the insurance and if he changes his allegiance to some other company, transfers a large proportion of his business,
4. As new policies come on the market or the Insured's situation changes, the old contract is replaced by a new policy.

Under these conditions there is a tendency for the good risks to drop their insurance and the poor risks to continue the protection. As the collection of a renewal premium may therefore involve almost as much salesmanship as the securing of the original application, the salesman is paid practically the same rate of renewal commission as of first commission.

Out of every dollar received in premiums from 45 cents to 55 cents is required for expenses including commissions, overhead, taxes and settlement of claims.

In an attempt to make the business more persistent, policies have been issued with "accumulations," that is, with an increase of 5 per cent or 10 per cent. in some of the benefits each year up to a total of 50 per cent. but this has merely led other companies to issue "fully accumulated" policies under which the increased benefits are granted from the outset.

In the early stages, policies covered only the first 26 weeks of total disability but the protection has been gradually extended to 52 weeks on Health policies and the entire period of total disability on Accident policies. Contracts almost invariably cover

from the first day of total disability but occasionally a rider may be attached excluding the first week or the first two weeks with a reduction in premium.

Accident companies have in general kept their experience in the form of a comparison of losses with gross premiums. This is a good method of recording experience by agencies. It is fairly satisfactory for determining results by policy forms if the benefits and rates remain unchanged. It is not suitable for combining the experience of several companies with varying policy provisions and premiums. It is not at all applicable if the benefits and rates change frequently as has recently been the case in Health insurance.

Eventually the Accident companies will probably combine their experience in such a way as to show the rate of accidental death by attained age and the rate of total disability and partial disability in weeks per person per annum by attained age.

No attempt has been made to trace the experience by policy year. In fact, it is generally supposed that as the business is virtually underwritten each year, there will be no material increase in claims with duration of policy.

Although comparatively few Accident statistics have been published it is generally supposed that the rates of accidental death and of disability due to injuries have been practically constant for all attained ages covered.

Mr. Messenger in the pioneer paper on "Rate of Sickness," *T. A. S. A.*, X, 371, gives the experience of the Travelers Insurance Company prior to 1907 in weeks of sickness per person per annum on a policy with a 26 weeks' limit covering total disability confined to the house. It shows practically a flat rate for ages 20 to 49 with the lowest point at ages 30 to 34. Above age 50 the rate gradually increases. Under a modern policy with a 52 weeks' limit or with no limit it is probable that the rate of increase will begin before age 50 and will be more pronounced as there is probably a larger proportion of long claims at the old ages.

In underwriting this business, the Company has the applicant's statements, inspection report, insurance records and, if apparently required, a medical examination. Each year it carefully reviews the records of each risk and on the larger cases secures a new inspection report in order to determine whether the Insured has become in any way impaired. At any renewal date the Company may call for a full medical examination before authorizing the renewal.

If a person is apparently a first-class risk with one exception, the policy may be issued with an "Impairment Rider" excluding any loss caused wholly or in part by a specific impairment—for instance, dislocated shoulder, hernia, or tonsilitis. Such an Impairment Rider may also be attached at a renewal date.

In the selection of risks the underwriter usually distinguishes between the Accident hazard including both death and disability and the Health hazard. Frequently, however, it is better to consider first, the death hazard, and then the disability hazard, regardless of whether disability is caused by injuries or illness.

Under the Death benefit the chief questions are:

1. What is the chance of accidental death?
2. What is the chance of fraudulent claim?
3. Is the total amount of insurance excessive?

Under the Disability benefit the questions are:

1. What is the chance of the applicant becoming disabled?
2. Will the duration of disability probably be short or long?
3. Will there probably be a recurrence?
4. How reasonable will the applicant be when a claim arises?
5. What is the chance of fraudulent claim and malingering?
6. Do applicant's earnings warrant the amount applied for in addition to all other insurance in force?

Agent: The place to begin underwriting is in the field. If the salesman associates with the best class of people and canvasses only those persons whom he believes to be good risks, his business will show a favorable experience and the Company will gradually acquire increased confidence in him. Salesmen with a consistently bad claim experience should be dropped and those with a favorable experience stimulated to greater production.

Occupation: The standard Classification Manual gives the ratings for exposure to injuries but frequently a distinction must be made between death and disability. So far as weekly indemnity is concerned, the policy covers loss of business time. It is therefore essential that this business time should be of value and should be capable of being measured; in other words, the applicant must be engaged in a steady remunerative occupation. Even though the employer may continue the man's full salary during disability, the man with a steady job feels the need of returning to his work at the earliest possible moment.

Men engaged in intermittent work are more likely to malinger. For this reason certain occupations are acceptable for policies covering only death or dismemberment but not for weekly indemnity. This distinction is made not because the occupation is hazardous but because the workers are temperamental, high-strung or irregular in employment—for instance:

> Author, artist, capitalist, musician, cartoonist, concert singer, ethnologist, lecturer, librettist, missionary not going to foreign lands, organist, retired man, sculptor, student at college.

In certain occupations there is a seasonal hazard—for instance, farmers whose main work comes in the summer sometimes show a tendency to suffer an accident or illness during the winter when comparatively little work has to be done. Similarly teachers may develop disability about vacation time and nurses may be required to take a complete rest in the dull season.

In certain occupations there is a moral hazard which puts the underwriter on his guard—for instance, in the case of a person who has been recently connected with the manufacture or sale of liquor or whose business is located amid undesirable surroundings. Similarly an application may be refused because the applicant's place of business is in his residence and it might be difficult to determine the actual period of disability.

In certain occupations there is a special hazard on account of the nature of the work. For instance, musicians and barbers would be seriously handicapped by injury to the hand or fingers. A similar situation exists among vocalists, actors and lecturers, where impairment of the vocal organs might constitute total disability. Sometimes the class of work is liable to bring on serious eye or nervous conditions.

In addition to these special classes there are certain occupations in which there is no specific hazard but experienced underwriters find that they show a higher rate of disability and cause greater difficulty in claim settlements.

Health insurance is not granted to persons exposed to occupational diseases, such as furriers, tanners, lead workers, pottery employees and felt hat makers, or to individuals engaged in processes involving the use of arsenic, mercury, wood alcohol, aniline dyes, mineral acids and poisonous gases. Similarly the companies will

not cover applicants exposed to unsanitary conditions, septicemia, dust, dampness, extreme heat or cold.

Age: At ages under 25 the habits of life may not be fully formed and the ultimate occupation and the applicant's success not yet determined. At ages over 55 there may be selection against the Company in the case of an applicant who feels that his physical condition is beginning to deteriorate or his earning power to become uncertain.

Residence: The best experience will probably be on persons residing in the northern and western parts of the United States or in Canada. Not only present residence but former and possible future residence must be considered. Any recent change of residence should be investigated as it may have been on account of poor health or bad financial or moral record. If the applicant is likely to travel on business or pleasure, the company must consider not only the additional hazard from injuries and sickness but also the greater difficulty in settling claims at remote points.

Family History: Particular attention is paid to any record of tuberculosis, cancer, insanity or disease of the nervous system.

Personal History: Even with good faith the applicant is liable to forget some injury or illness which might affect his insurability. Sometimes the agent or medical examiner can supplement his statements with valuable information. If the record reveals any history of accident or illness, a report from the physician in attendance at that time may be helpful. In certain specific injuries such as dislocation of knee or shoulder, there is liable to be a repetition of the trouble. In other cases the record indicates that the applicant is one of those unfortunates who apparently have a curious faculty for getting hurt. The personal history may indicate susceptibility to recurrent illnesses such as asthma, grippe, pleurisy, bronchitis, tonsilitis and rheumatism, or a tendency to prolonged disability due to such diseases as tuberculosis, insanity, paralysis, nervous breakdown or blindness.

Physical Condition: Particular attention should be given to the eyes, ears, throat, teeth, varicose veins and any serious deformity. If he has lost one hand or one foot or one eye, he should be charged an extra premium. If he has lost one eye by disease, he should probably be declined because of the danger of the other eye being involved, though possibly if the loss occurred some years prior to the application, he may be insured at an extra premium.

Persons more than 20 per cent. overweight or underweight are probably more susceptible to disease than persons of standard weight and furthermore if injured probably take a longer period to recover. Light weight at the young ages, particularly if there is a personal or family history of tuberculosis, may be a serious impairment. Overweight, especially at the older ages, may be cause for rejection. The underwriter must consider habits in regard to drinking, morality, overeating, insufficient exercise, recklessness, lawlessness and the use of drugs.

Over-insurance: The maximum amount payable in case of death by accidental means including double, triple, or quadruple indemnity, and all other Accident and Life insurance in force should be considered in relation to the applicant's net worth and probable earnings. The maximum amount of weekly indemnity for disability obtainable under all his insurance policies including permanent total disability with Life insurance should not exceed 80 per cent. of his net earnings.

Women: A woman will be considered if engaged in a gainful occupation which requires her to leave her residence daily. Even though the contract does not cover sickness or disease of the organs peculiar to women, it has been found that women are subject to a higher rate of disability than men. Usually they are granted less liberal contracts than the best forms issued to men and on Health insurance are charged a higher premium. Frequently it is more difficult to make a satisfactory claim settlement with a woman as she is less likely to appreciate that the contract does not cover pain and suffering but merely complete loss of business time caused by sickness or disease.

Strangers: Strangers and those voluntarily applying for insurance are looked upon with suspicion.

Development.

In Commercial Accident and Health insurance the contract covers a term of twelve months or less and relatively few claims run more than 52 weeks. The experience on policies issued or renewed in any particular calendar year is therefore practically complete within two or three years thereafter. If the business has been unprofitable or if unfavorable Court decisions have extended the coverage beyond the limits originally intended, the company can

immediately change the basis for new contracts and may even raise the rates or limit the coverage on renewals.

Usually it has seemed best to renew the old contracts without change of benefits or rates. For instance, a few years ago several companies increased the rates for Health insurance by about 30 per cent. Under the contracts they could have made this increase in rates retroactive but they felt that it was better to continue the outstanding policies at a loss and apply the advanced rate only to entirely new contracts. In an extreme case, however, the company has the right to increase the rates on old policies or to refuse to renew the coverage on any basis.

On Accident insurance the rates and benefits have not been materially changed in the last ten years. The business has been profitable for the companies and satisfactory to the public.

On Health insurance the companies formerly paid full indemnity for house confinement and only partial indemnity for total disability while not confined. These contracts were, however, unsatisfactory to the policyholders as it seemed unreasonable to reduce the indemnity by 50 per cent. merely because the sick man was able to go out of the house for a walk or automobile ride. A few years ago the benefits were liberalized to provide full indemnity for total disability whether confined or not confined and partial indemnity for partial disability. Since that time Health insurance has been unprofitable. The bad experience has been due in part to the influenza epidemic and in part to the difficulties inherent in Health insurance. Recently some companies have eliminated partial disability and hope in this way to improve conditions.

Apparently there is a stronger selection against the companies in Health insurance than in Accident or Life insurance. A healthy person realizes that he is sure to die and that he may have an accident but he belittles the probability of serious illness. Even if the strong man purchases a Health policy, he is likely to drop it within a few years if he has no claim. Furthermore, it is difficult for companies to eliminate those persons who take the insurance because they instinctively feel that they are below standard or have a slight susceptibility to disease.

Similarly it is difficult to determine whether a claim for sickness is genuine. Even though the policy covers only sickness or disease for which the Insured is treated by a physician, the degree

of disability and the duration may be determined largely by the individual's state of mind.

One prominent underwriter has summed up the situation as follows:

"To have a claim under Life insurance one has to die to win; under Accident insurance, one has to meet with an accident; but under Health insurance one has to have—a policy."

II. NON-CANCELLABLE ACCIDENT AND HEALTH INSURANCE.

Prior to 1915 practical underwriters felt that the Cancellation clause was essential for the protection of the Company against unforseen contingencies and fraudulent claimants. In that year, however, one or two companies began to issue Accident and Health insurance renewable to age 65 without the right to cancel. In these early contracts the premiums increased with the age at issue.

The progress of the Non-Cancellable idea was slow as the companies themselves were somewhat conservative and it was difficult to feature the new coverage without at the same time attacking the well-established Commercial business. In the general public the only person who fully appreciated a Non-Cancellable policy was the one who had recently had a Commercial policy cancelled because of impairment.

Non-Cancellable policies cover:

1. Accidental death.
2. Disability caused by injury or sickness.

Accidental Death.

Some companies which cover accidental death under Commercial policies refuse to grant this benefit on the Non-Cancellable form. Under Commercial policies if unfavorable Court decisions on borderline cases should lead to a gradual extension of the accidental death coverage beyond the limits now understood, the companies could protect themselves against further loss by use of the cancellation privilege, but under Non-Cancellable policies there would be no such remedy.

Disability.

The chief interest in the Non-Cancellable policy lies in the Disability benefit.

A few years ago some companies, after considerable experience

with Commercial contracts under which 50 per cent. of the disability claims occur in the first two weeks and 85 per cent. in the first three months, began to issue Non-Cancellable Disability insurance usually with a waiting period varying from two weeks to three months. These contracts were issued only after medical examination and were sold at a flat rate regardless of age at issue. Apparently it was not fully appreciated that the effects of medical selection might soon wear off and that the rate of disability must increase with duration of the policy and with increase in age.

Early in 1921 the Bureau of Personal Accident and Health Underwriters made a thorough investigation of Non-Cancellable insurance and made definite recommendations to the member companies. Every company now charges a rate depending on the age at issue and presumably sets aside reserves to cover the inevitable increase in claims as the Insured becomes older.

Some companies still issue Non-Cancellable policies covering disability from the first day but the majority feel that such a contract presents too great an opportunity for repeated claims of short duration. This has sometimes been known as "Vacation" insurance inasmuch as a certain type of policyholder may each year get his physician to recommend a few weeks at the company's expense in Maine in the summer and in Florida in the winter.

The Non-Cancellable policy is primarily intended to give permanent protection against injuries or illness and the person who buys the contract in good faith can usually take care of the first two weeks or even three months of illness and will therefore prefer a policy with a reasonable waiting period issued at a lower premium. Such a waiting period not only reduces claim payments but also eliminates the expense of investigating a great many trivial claims.

Life insurance companies have profited by an improvement in mortality among insured lives, particularly at the young ages. It has not however been demonstrated that there has been a corresponding reduction in the rate of sickness. In fact, Mr. A. W. Watson has shown that in the Manchester Unity Experience an improvement in mortality has invariably been accompanied by an increase in the rate of disability. Even if the rate of disability should remain constant, an improvement in the rate of mortality would cause increased disability claims as a larger proportion of the insured lives would survive to the old ages where the rate of sickness is heaviest.

It is probable that under a Non-Cancellable policy there will be a tendency for the good risks to drop their insurance and for the poor risks to cling tenaciously to the coverage as long as they have hope of collecting indemnity from the insurance company.

British companies have issued Non-Cancellable Disability insurance for more than 25 years. Under their contracts disability payments cease entirely at the limiting age, usually 65. Under American policies the limiting age is 60 but payments are continued thereafter if disability began before age 60.

For a Non-Cancellable policy with a three months' waiting period the gross premiums for standard risks in one British and two American companies are:

GROSS PREMIUMS PER $10 A MONTH.

Age at Issue.	Company *A* (British).	Company *B* (American).	Company *C* (American).
20	$2.62	$2.33	$2.00
25	2.94	2.65	2.10
30	3.34	3.02	2.25
35	3.96	3.43	2.45
40	4.99	3.95	2.70
45	6.10	4.66	3.20
50	7.56	5.70	3.95
55	Not issued	7.43	4.95

Although a large proportion of the claim payments will undoubtedly be due to sickness and although Commercial Health rates do not vary with occupation, American companies have graded their Non-Cancellable rates according to classification of occupation. Furthermore, they have given physicians, surgeons and dentists a more unfavorable rating than under Commercial contracts.

For a Non-Cancellable policy with a three months' waiting period providing $10 a month for total disability occurring before age 60 the gross rates of the two American companies at age 35 are:

Classification.	Company *B*.	Company *C*.
Select and Preferred	$3.43	$2.45
Extra Preferred (except physicians, surgeons and dentists)	4.29	2.69
Ordinary	4.63	2.69
Physicians, surgeons and dentists	4.63	3.05

Although most American policies contain a provision for prorate in case of change of occupation, this clause is of considerably less importance than under Commercial Accident and may gradually be eliminated.

Under a policy with a three months' waiting period certain risks may properly be accepted which would not be eligible for a Commercial contract paying from the first day of disability or for a Non-Cancellable policy paying from the fifteenth day of disability. The three months' waiting period practically eliminates the hazard of short disabilities from trivial injuries such as dislocation of shoulder and temporary illness such as tonsilitis.

To guard against over-insurance on the Non-Cancellable form most companies now limit the coverage on any one life to $500 a month including policies in other companies.

A reduction in earnings after the insurance has been issued may create an unfavorable situation on account of over-insurance. Under Commercial Accident and Health policies it has been customary to cancel the insurance if it is known that the Insured's earnings have been reduced by the vicissitudes of business. As this privilege of reducing the indemnity is absent from a Non-Cancellable policy, some companies have attempted to protect their interest by inserting the following provision:

"Indemnity for disability will not be paid under this policy at a rate in excess of the average earnings of the Insured for the period of time that he has been actually employed during the two years immediately preceding the commencement of the disability for which the Company is liable, and all premium paid during said two years for that portion of the disability indemnity in excess of the amount of such earnings will be returned upon request of the Insured."

On account of the experience on Commercial policies, all companies refuse to issue the Non-Cancellable form to women.

Some Non-Cancellable policies resemble the Commercial contracts in benefits and commissions. They provide double indemnity for certain injuries and cover accidental death, partial disability, surgical and hospital fees. The rate of renewal commission is not much lower than the first-year commission.

Other Non-Cancellable policies place the entire emphasis on income protection, and cover only total disability with relatively few frills. The rate of commission resembles the rates paid for

Life insurance on the theory that the success of the Non-Cancellable program depends on a low rate of expense which will enable the company to give a large return to the policyholder.

Although Non-Cancellable policies are sold by Commercial Accident and Health insurance agents they apparently appeal still more to Life insurance salesmen. Life insurance salesmen like a premium graded by age at issue as they know it makes the business more persistent and they appreciate the value of a medical examination. Many Life insurance men are building up a good business on the Non-Cancellable form as a supplement to Life insurance protection.

III. ACCIDENT AND HEALTH INSURANCE UNDER LIFE INSURANCE CONTRACTS.

Two forms of Accident and Health insurance are now covered under Life insurance policies:

1. Principal sum for accidental death.
2. Monthly indemnity for permanent total disability.

Accidental Death.

It has been held that the Accidental Death benefit is illogical and that the Insured needs as much protection against death by typhoid fever as against death by accidental means. On the other hand, there is a public demand for extra coverage against accidental death and this protection can be furnished in conjunction with Life insurance at lower rates than under Commercial Accident policies.

If most people purchased Life insurance up to the limit of their insurable value, there would be no need of the additional accidental death coverage but so long as the majority are under-insured, there is reason for providing a means by which they can secure more adequate protection even though that protection is available only in case of death by accidental means.

Life insurance companies have in their own mortality records a fairly reliable guide as to the net premiums required for this Accidental Death benefit. They can however profit by the experience of the Accident companies in regard to over-insurance and settlement of borderline cases.

Permanent Total Disability.

Disability may be either total or partial. It may be permanent or temporary. Strictly speaking, total disability is permanent only if it continues until death. It is frequently difficult to determine in advance whether a specific case of total disability will presumably be permanent.

Life insurance companies are permitted by law to cover permanent total disability but the definition of what constitutes permanent total disability has been left open and has been continually liberalized.

Three different types of disability are recognized under the expression "Permanent Total Disability":

1. Total disability which has continued throughout a probationary period of a few months and which, so far as can then be determined, will probably continue until death. In many cases it is practically impossible to determine with accuracy whether disability will terminate by death or recovery and this is particularly true if the probationary period is short or is entirely eliminated. Furthermore in the case of a total disability which actually lasts two years, there is no good reason for granting benefits during the greater part of this period if the final outcome is death, and denying these benefits if the final outcome is recovery. The need of the policyholder is determined primarily by the length of the illness rather than by the outcome.
2. Temporary total disability which has lasted through a probationary period and which is thereupon classified as permanent by the mere lapse of time even though the Insured may then be on the road to recovery. This definition is much more satisfactory than No. 1 as it eliminates all conjecture about the future, and gives definite benefits depending on the length of time the Insured is disabled.
3. Serious dismemberment such as the loss of the sight of both eyes or the loss of both hands, both feet or one hand and one foot. Under this definition benefits are paid even though the Insured is not disabled at all. For instance, a banker who loses both feet can return to his place of business, perform practically all his regular duties and still draw benefits. This provision is illogical but in the early days it helped the salesman and the prospect to visualize

the benefits. Permanent total disability is a most elusive thing but the loss of both feet is something tangible.

It seems unfortunate that the law requires Life insurance companies to retain the word "permanent." The situation would be greatly clarified if companies were in a position to state openly that they cover any total disability after a waiting period of, say, three months. If the policyholder can finance himself during the first three months in the case of a temporary illness, he can also do it for such a period in the case of a permanent illness and therefore there is no real need to pay the benefits during the first three months even in those cases which are from the outset avowedly permanent—for instance, irrecoverable insanity.

Life insurance companies have at present apparently standardized on two liberal definitions of permanent total disability:

1. Coverage from the first day if it is presumably permanent.
2. Coverage from the end of three months whether it is permanent or temporary.

One company grants coverage from the end of two weeks whether it is permanent or temporary.

As the definition of permanent total disability is liberalized, there is a corresponding increase in the number of claims. Hunter's Tables have been used as the standard under the old definitions of permanent total disability where for instance claim is allowed if the Insured has been totally disabled for six months and presumably will continue to be totally disabled. Under the more liberal definitions of permanent total disability some other table must be taken as the standard, for instance, the Manchester Unity or Cammack's combination of the Manchester Unity and Hunter's Tables as given in the Transactions of the Causalty Actuarial Society, VII, 267.

From a consideration of these tables it has been estimated that if 100 men take insurance at age 30 and continue their policies to age 60, the number of claims for permanent total disability depending on the definition adopted will be as follows:

Definition of Permanent Total Disability.	Number of Claims per 100 Persons Entering at Age 30.
Total disability must have lasted six months and be then presumably permanent	4
Any total disability after a waiting period of three months	57
Any total disability after a waiting period of two weeks	443

The actual experience on policies now being issued may differ materially from the figures given above but at any rate the number of claims will be much greater under the second definition than under the first and will be still greater under the third. This increase in the number of claims with corresponding reduction in the average duration and increase in the proportion of recoveries introduces new elements into the problems of selecting risks and settling claims.

Fortunately Life insurance companies in interpreting the Disability provision have not been required to draw a distinction between accident and disease. They have almost invariably covered any total disability whether caused by injury or sickness. One company has recently complicated the situation by paying $10 a month for disability caused by sickness and $20 a month for disability caused by injuries sustained by accidental means, but so far there has not been any general tendency to make such an arbitrary distinction.

Life insurance companies have in general defined total disability as "inability to perform the duties of *any* occupation." One company now offers to business and professional men a choice between this standard definition and a more liberal contract, issued at an extra premium of 20 cents per $10 a month, defining total disability as "inability to perform the duties of *his* occupation." Some of the Accident underwriters feel that it is unwise to feature a distinction of this kind and that, particularly where an option is granted, it is a direct invitation to the fraudulent person to take the more liberal wording and collect from the insurance company for a change of occupation. For instance, a clergyman who had trouble with his voice might give up preaching and become a successful bookstore proprietor. Similarly, a doctor or physician who lost the use of his right hand or whose sight became impaired might turn to some more lucrative occupation and yet collect full indemnity under this policy.

Undoubtedly the expression "any occupation" gives the insurance company an additional defense against the fraudulent claimant. So far Life insurance companies have not used this language as a defense against the legitimate claimant. It is inconceivable that any well-established company should deny liability on the ground that notwithstanding injury or illness a lawyer could engage in the occupation of selling lead pencils on a street corner.

Furthermore, it is most improbable that any Court would uphold the insurance company in such a position.

Disability Underwriting.

Disability introduces several problems not found in Life insurance alone. Life insurance contracts running for a long period are usually issued on the Life or Endowment plan under which the amount at risk decreases each year and therefore the effects of an unfavorable experience in the later years are minimized. Disability benefits issued at age 30 and ceasing at age 60 are virtually 30-Year Term contracts under which the amount at risk consists of the commuted value of future claim payments. According to Cammack's Tables, on a policy covering any total disability lasting more than three months this commuted value for each $10 a month increases from $74.80 at age 30 to $133.00 at age 60. The Disability provision is therefore a 30-Year Term contract for an increasing amount at risk.

The Disability benefits granted in conjunction with Life insurance differ materially from Commercial Accident and Health insurance but closely resemble Non-Cancellable policies. Commercial contracts are issued without medical examination and cover from the first day of disability. Non-Cancellable policies and Disability benefits with Life insurance are issued only after full medical examination and in general cover disability only after a waiting period. The experience on Disability benefits granted with Life insurance should be more favorable than on Non-Cancellable policies because there will probably be less selection against the Company not only in taking the protection but also in continuing it, if Life insurance is the main consideration and Disability benefits are more or less incidental. In spite of this distinction, however, Life insurance companies have something to learn from the experience under Commercial contracts and the precautions taken by Accident companies on Non-Cancellable policies.

Under the old type of permanent total Disability clause only 4 per cent. of the claims were caused by accident and 96 per cent. by disease. Under the more liberal types now being issued there will undoubtedly be a larger proportion of claims due to accident but probably 85 per cent. will still be due to sickness. This means that Life insurance companies have embarked on Health insurance,

the field of Commercial business which has been most difficult to handle on a satisfactory basis.

The problem of over-insurance is common to all three lines of Personal Accident and Health insurance. In the old days when Commercial Disability benefits ceased at the end of 52 weeks just about the time when the permanent total Disability benefits under Life insurance commenced, there was little, if any, overlapping. Today it is quite possible for the Insured to draw $250 a week under a Commercial Health policy and at the same time $500 a month for permanent total disability under his Life insurance.

In considering an application, it is therefore important to know exactly how much weekly or monthly indemnity is obtainable under all his Accident and Health insurance including Commercial, Non-Cancellable and Disability with Life insurance. Unfortunately it is hard to obtain this information as frequently the applicant himself does not know just what benefits are payable under various policies, particularly if his contracts provide double, triple or quadruple indemnity. Having determined the total amount of indemnity under all policies as accurately as possible, the underwriter must see how this compares with the applicant's average earnings excluding income from investments. He must consider not only the average earnings today but what they will probably be five, ten or fifteen years in the future.

For instance, a physician who is now earning $2,000 a month may be considered eligible for Disability benefits up to $1,500 a month. Five years from now he has passed the peak of his earning power and his average monthly income drops to $1,000. If part of his disability indemnity is on Commercial contracts and if the reduction in his earning power becomes known, the companies can cancel the Commercial insurance and leave him with a reasonable amount of indemnity under his Non-Cancellable insurance and his Life insurance. If, however, his entire coverage is on Non-Cancellable and Life insurance contracts, then the companies have in force insurance of $1,500 a month on a person whose earnings are only $1,000 a month.

The problem of over-insurance was brought forcibly to attention by the general reduction in earnings during 1920.

Should Business insurance on the life of an executive for the benefit of a partnership or corporation provide monthly income for permanent total disability? Some companies hold that protection

against death is sufficient and that there is no need of covering permanent total disability. Others take the view that absence of such an executive on account of sickness or injury is a genuine loss to the partnership or corporation and that it is reasonable to grant indemnity. It is possible that in an extreme case a corporation might be willing to give an officer a prolonged vacation at the insurance company's expense, but where the business is properly underwritten it seems reasonable to grant disability income payable to the corporation. One insurance company does not grant disability income with Business insurance but pays the face of the policy upon death or permanent total disability.

Several classes of risk which are considered ideal for Life insurance are less desirable for Health insurance and Non-Cancellable insurance—for instance, farmers, ministers, doctors and dentists. Sometimes racial characteristics which favor the company in Life insurance operate against it in Accident and Health insurance. Certain risks are accepted by Accident companies for death and dismemberment but not for weekly indemnity. This distinction is made not because the occupation is hazardous but because the workers are temperamental, high-strung or irregular in employment, having no regular daily duties to perform—for instance, author, cartoonist, capitalist or retired man.

Under Life insurance policies with a three months' waiting period there is practically no "seasonal" hazard but if the waiting period is reduced to two weeks or even one month, then this factor must be considered.

A great many Life insurance companies grant disability income to business women at the same rates as to men. In this respect they are departing from the practice of the Accident companies which have had an unfortunate experience with women. The distinction may be partly justified by the long waiting period and the comparatively small benefits granted with Life insurance in the past but as the waiting period is reduced and the relative value of the Disability benefits increased, it is possible that the Life insurance companies may also have an unfavorable experience and may have to charge a higher rate for disability granted to women or even refuse the complete coverage.

Claim Organization.

For settling claims Accident companies have built up an organization usually consisting of several men at the Home Office and other representatives located at various strategic points where there is a sufficient volume of business. To a great extent success depends on the efficiency of the Claim Department. Claims must be handled with promptness and tact. After a claim has been approved, the representatives must keep in touch with the situation in order to discontinue payments upon recovery. Their work is frequently misunderstood as when dealing with a dishonest policyholder they must use every legal means to protect the Company's interest. By far the greater part of their work however is with honest policyholders and consists of ascertaining the facts, explaining the coverage and making prompt and equitable settlement.

Under the old type of Life insurance contract with no provision for Accident and Health benefits it has been comparatively easy to determine the Company's liability and make prompt settlement. Under the Accident and Health provisions now incorporated in Life insurance there will be a larger proportion of borderline cases requiring the services of a trained Claim Department. Companies must avoid on the one hand unnecessary disputes and litigation and on the other hand such liberal settlements as may later be used as precedents for an undue extension of the policy coverage.

IV. THE OUTLOOK.

Accident and Health insurance has become an integral part of Life insurance. Under this combination the company can give a greater return to policyholders than under separate Accident and Health policies because there is a reduction in the selection against the company and in the acquisition expense and an increase in the persistency of the good business. Furthermore, the coverage in conjunction with Life insurance has in general been confined to the two major benefits—principal sum for accidental death and income protection during prolonged total disability.

Several Life insurance companies have recognized that these Accident and Health benefits in conjunction with Life insurance do not fully meet the needs of the insuring public. For instance, a person may desire more disability protection than he can obtain at the rate of $10 a month with each $1,000 of Life insurance or

may wish a greater amount of disability protection than the company's absolute limit under permanent total Disability and Non-Cancellable insurance. Sometimes the prospect is primarily interested in disability coverage from the first day or in protection against partial disability. In spite of the development of Disability benefits with Life insurance and of the Non-Cancellable idea, there is therefore still room for Commercial Accident and Health insurance. Many Life insurance companies have accordingly established an Accident and Health Department for the purpose of issuing Non-Cancellable and Commercial Accident and Health insurance. In this way they round out the complete circle of personal insurance protection.

Frequently an agent has begun his insurance career on Commercial Accident and Health insurance where a quick sale can more readily be made and has later become an expert Life insurance salesman.

Whether the Accident and Health benefits are issued only in conjunction with Life insurance or as entirely separate policies, the company must educate underwriters, salesmen, medical examiners and inspectors to appreciate the new problems. They must learn to distinguish the accidental death hazard and the sickness hazard from the life insurance hazard.

If the company is unnecessarily severe in underwriting the Accident and Health benefits and rejects a number of risks which would have been acceptable for Life insurance alone, the salesman's enthusiasm for the new coverage will soon wane. For this reason some companies which issue only standard Life insurance may find it necessary to grant Accidental Death benefits and Disability benefits at sub-standard rates in order to avoid disappointing the applicant and the salesman.

The rates charged for Accident and Health insurance should be adequate to cover all claims, specific expenses and pro rata share of miscellaneous expenses. Separate accounts should be kept to show the company's gain or loss on Accident and Health benefits granted with Life insurance and on the separate Accident and Health policies.

With reasonable precautions Life insurance companies can materially increase their usefulness by gradually extending their contracts in such a way as to give either with or without Life insurance the essential features of Accident and Health insurance.

Discussion of Preceding Paper.

(WRITTEN DISCUSSION.)

MR. B. D. FLYNN:

Mr. Laird in the first part of his paper which deals with Commercial Accident and Health insurance, has covered clearly and thoroughly the many phases of this important line of underwriting. The reader is given a general outline of the contracts, the benefits provided, the makeup of rates, the method of rating, and the more important features of underwriting. As a matter of fact, this part of the paper is so nearly complete that it leaves little for discussion or comment. One might go further in discussion of some points—for example, the change in the apportionment of accident pure premium cost by kind of benefit as the hazard of the class increases. There would be no particular point in doing this, however, as Mr. Laird has accomplished his purpose—which was to give to the student a good working knowledge of the many problems met in handling this important form of insurance.

In the second part of the paper, which deals with Non-Cancelable Accident and Health insurance, Mr. Laird is, in the writer's opinion, a bit too optimistic of what the future holds, both with regard to the volume of business to be written in this line and the underwriting results. Mr. Laird points out the danger of over-insurance and refers to a clause which has been utilized by one or two companies, intended to safeguard the company against decrease in the policyholder's earning capacity in later years. It should be pointed out, however, that the great bulk of the business which has been written and the majority of the contracts used today do *not* contain this safeguarding clause and, therefore, have no real check against the possible future losses from this cause. Further, there is a serious question if this form of contract will sell widely if such a clause is inserted.

Then again there is another danger which in the opinion of many underwriters is most important—namely, the deterioration in the moral and physical condition of the risk as the years go on. The cancelation clause in the Commercial contract is intended to safeguard the insurance carrier if the condition of the person insured deteriorates to such an extent as to take him out of the insurable class.

Non-Cancelable Accident and Health insurance, as Mr. Laird points out, is in its infancy in this country. It is comparatively easy, however, to see the possible dangers which may be met in this form of protection. We know that the British companies have a contract which is much more restricted than that which is now issued in this country; further, that their gross rates are higher, although expenses are probably lower. It is true that the rates at which the Non-Cancelable contracts are now issued in

this country are much sounder than those which were used by the companies a year or two ago; still, in the minds of many careful and experienced accident underwriters, the development of the Non-Cancelable business should be slow and results watched carefully. There is a question in the minds of some as to the wisdom of an insurance company offering an opportunity to the general public to acquire a contract under which a large part of the claim cost may be incurred by persons who are selecting against the company. Their contention is that Health insurance should be provided only for the person who is insurable as measured by certain definite standards, both physically and morally; that the amount of insurance should be gauged upon the basis of his current earnings; and that, further, as soon as a person passes out of this insurable class, his insurance should cease—otherwise, the cost of protection for these uninsurable risks must be charged to the insurable policyholders.

In Part III, which deals with Accident and Health insurance under Life insurance contracts, Mr. Laird discusses a subject which is of vital importance to Life underwriters at the present time. With regard to the additional accidental death benefit, Mr. Laird feels that there is reason for providing a means by which the purchasers of Life insurance can secure more adequate protection in event of accidental death. I am inclined to disagree with the author in this matter. It appears to me that the additional death provision in a Life contract is similar to the double indemnity frill in the Accident insurance contract. There is no more justification for one than the other. There is always a weakness, in that it is possible for the agent to feature the double amount of insurance in selling the Life contract and possibly to give an impression which exaggerates the value of this additional protection. Undoubtedly the additional death benefit in Life contracts has come to stay, but let us hope that it is not the forerunner of further extensions of other frills in the form of dismemberment benefits, surgical benefits, and so on.

Mr. Laird's comments with regard to the permanent total disability benefit in Life contracts are most interesting and valuable. He states that some of the Life companies are actually providing Non-Cancelable benefits in event of total temporary disability, and that one furnishes in effect Non-Cancelable Accident and Sickness insurance with a two weeks' waiting period. In the opinion of the writer, no company should go into this line of underwriting unless after a thorough understanding of the possible dangers of the Non-Cancelable business it is willing to take up this line with its many difficulties and administrative problems. As Mr. Laird points out, a certain amount of monthly indemnity as total disability benefit can only be obtained by the purchase of a large amount of Life insurance at a comparatively heavy premium cost, but the disability coverage is Non-Cancelable insurance, nevertheless, and mainly made up of the health insurance

element. Mr. Laird makes several significant statements—first, he says "This means that Life insurance companies have embarked on Health insurance, the field of Commercial business which has been most difficult to handle on a satisfactory basis," and then again, he says: "Life insurance companies have something to learn from the experience under Commercial contracts and the precautions taken by Accident companies on Non-Cancelable policies." Most Accident underwriters with whom the writer has talked have predicted trouble ahead for the Life insurance companies which are developing the permanent total disability benefit along the lines of a temporary total disability benefit similar to the protection given under a Non-Cancelable Accident and Health policy. Let us hope that the companies which are providing in their Life contracts indemnity for temporary total disabilities beyond the first two weeks, or for a different amount of indemnity for disability due to Accident from that due to Sickness, are receiving the advice of an experienced Accident underwriter and are properly equipped for handling satisfactorily this casualty line.

There is one brief division of Mr. Laird's paper which should be given considerable thought—namely his reference to the necessary claim organization in a Life insurance company if the many short temporary total disabilities are to be investigated and necessary claim payments made. The adjustment of Accident and Sickness claims must be made in an intelligent manner by experienced claim men. It will not be possible for a company with a reputation for equitable and intelligent handling of Life insurance death claims to permit other than the highest class of work in connection with its disability claims. This will require considerable expense and an efficient administrative organization.

In conclusion, I should like to repeat the admonition that the Life insurance company which is going in for Non-Cancelable Accident and Health benefits, should do so only after looking into all phases of the problem thoroughly and after determining to work out this form of insurance in a careful and intelligent way.

MR. J. E. FLANIGAN:

I am particularly interested in Part III of the paper dealing with Accident and Health insurance under Life Insurance Contracts. That portion devoted to the Accidental Death Benefit is rather brief, most of it being devoted to a justification for issuing the Accidental Death Benefit in connection with Life Insurance Policies. It seems to me that one of the most important reasons for issuing such a benefit is that it helps to sell more life insurance, and any extra which adds to the benefits under the Life Insurance Contract without loss to the company, at the same time helping the sale of the Life Insurance Contract, is of distinct benefit to the business of life insurance.

I would also like to point out that the experience under this benefit will be governed very largely by the following factors:

(1) The rates charged.
(2) The underwriting principles followed.
(3) The proportion of business sold with such benefit.
(4) Whether full commission is paid or not on the premiums for such benefit.
(5) The size of the company and its organization, including Claim Department.

The rate charged should depend upon the other factors mentioned above. The benefit can be sold at a lower rate where the agents are urged to sell it so that a large proportion of the business is placed with the accidental death coverage. This will have a tendency to minimize the effect of selection against the company with particular reference to fraudulent cases. It goes without saying that when full commission is paid upon the premium for this benefit the proportion of life insurance issued by the company with Double Indemnity attached will be at its maximum.

Mr. Laird refers to the mortality experience of the life insurance companies as being a fairly reliable guide as to the net premiums required by this benefit. Such rates, however, should be used with great caution, as it has not yet been shown that there is not a substantial increase in the proportion of death claims due to accident on Life Insurance Policies, to which Accidental Death Benefits are attached, as compared with policies to which such benefits are not attached. I am satisfied from our own experience that there are quite a few claims which must be settled as accidental death, although we are reasonably satisfied that the cause is suicide, because the company would have very little chance in court.

As to permanent total disability, our company has been issuing for some time the type of benefit where the insured is presumed to be permanently disabled (subject to recovery) after he has been continuously totally disabled for three months. As would be expected, a fair proportion of the claims now arising are obviously of a total temporary nature, such as severe but not permanent injuries, typhoid fever, etc.

In reviewing these claim cases, the question of reserves for them immediately became important. As a number of the claims were of a total temporary nature and as our claims have all been incurred within the last few years, it seems to me that Hunter's Table would give far too large a reserve if applied to these claims. Hunter's Table is unsuitable because it is not on a select basis. Mr. Cammack's Table, mentioned by the author, has the advantage of being upon a select basis, but I can hardly believe that the reserves contained in his Table are sufficiently large for a valuation of disability claims as found in practice in this country. The following is a comparison of the reserves by various standards:

CLAIM RESERVES.

Age 20 When Disability Starts.	Term Disability Has Run.			
	1 Yr.	2 Yrs.	3 Yrs.	4 Yrs.
Cammack's Table $3\frac{1}{2}\%$....	$ 210.00	$ 362.00	$ 484.00	$ 647.00
Hunter's Table 3% $120a_x^s$..	619.00	738.00	778.00	817.00
U. S. Population 1910 3% $120a_x$.....	2,773.00	2,747.00	2,721.00	2,693.00
U. S. Population 1910 $3\frac{1}{2}\%$ $120a_x$.....	2,556.00	2,534.00	2,513.00	2,490.00
	5 Yrs.	6 Yrs.	7 Yrs.	8 Yrs.
	$ 929.00	$1,104.00	$1,201.00	$1,251.00
	856.00	893.00	926.00	957.00
	2,665.00	2,636.00	2,606.00	2,576.00
	2,466.00	2,442.00	2,417.00	2,391.00

Age 40 When Disability Starts.	Term Disability Has Run.			
	1 Yr.	2 Yrs.	3 Yrs.	4 Yrs.
Cammack's Table $3\frac{1}{2}\%$....	$ 427.00	$ 737.00	$ 794.00	$ 829.00
Hunter's Table 3% $120a_x^s$..	1,018.00	1,011.00	1,003.00	995.00
U. S. Population 1910 3% $120a_x$.....	2,143.00	2,106.00	2,069.00	2,030.00
U. S. Population 1910 $3\frac{1}{2}\%$ $120a_x$.....	2,019.00	1,986.00	1,953.00	1,919.00
	5 Yrs.	6 Yrs.	7 Yrs.	8 Yrs.
	$ 828.00	$ 827.00	$ 827.00	$ 827.00
	986.00	977.00	968.00	958.00
	1,992.00	1,953.00	1,913.00	1,873.00
	1,885.00	1,850.00	1,815.00	1,779.00

Age 60 When Disability Starts.	Term Disability Has Run.			
	1 Yr.	2 Yrs.	3 Yrs.	4 Yrs.
Cammack's Table $3\frac{1}{2}\%$....	$ 325.00	$ 636.00	$ 745.00	$ 740.00
Hunter's Table 3% $120a_x^s$..	835.00	831.00	826.00	821.00
U. S. Population 1910 3% $120a_x$.....	1,313.00	1,271.00	1,229.00	1,188.00
U. S. Population 1910 $3\frac{1}{2}\%$ $120a_x$.....	1,267.00	1,228.00	1,189.00	1,150.00
	5 Yrs.	6 Yrs.	7 Yrs.	8 Yrs.
	$ 736.00	$ 730.00	$ 724.00	$ 716.00
	816.00	810.00	803.00	795.00
	1,147.00	1,106.00	1,065.00	1,025.00
	1,111.00	1,073.00	1,035.00	997.00

It should be borne in mind that Mr. Cammack's reserves are upon a 3½ per cent. basis and Mr. Hunter's are upon a 3 per cent. basis. I would like to suggest an arbitrary method, which I believe in view of our lack of suitable Tables, would give a more correct reserve on the whole than the use of either Mr. Hunter's or Mr. Cammack's Tables; namely, to divide the claims into groups, estimating the probable duration in years. I would suggest that they be divided into those where the probable disability would be one, two, three, four and five years, considering all those beyond five years as permanent, and valuing all the temporary groups upon an annuity certain basis for the estimated time to run and those that are considered permanent upon a population table for the United States.

It is my understanding that Hunter's Table has been written into the Statutes of some of the states as a standard of valuation for claims under permanent total disability clauses and it may be that the valuation made upon any other basis would not be acceptable to such Insurance Departments, but I believe that this objection might be overcome for the present by preparing approximate reserve figures, as outlined above, and then transferring such reserves into percentages of the reserves shown by Hunter's Table.

The author mentions a new Disability clause issued at regular rates plus an extra premium of twenty cents annually for each $10.00 per month of disability, where the total disability is defined as "inability to perform the duties of *his* occupation." It is the company with which I am connected that is issuing this disability and I, therefore, feel it necessary to give a little more information concerning it. One of the greatest drawbacks to the regular Total Permanent Disability clause is that section defining total disability with reference to the pursuit of work. While working upon this language with a view to clarifying it and making it more definite from a sales standpoint, we evolved the new Disability clause which we are now issuing, but it was deemed necessary to limit its use to certain well-defined professional and business occupations. It was felt that any attempt to defraud could largely be prevented by certain measures, as follows:

(1) Training of agents to solicit only the new clause where the applicant is eligible for it.
(2) Limitation of the amount of income to $250.00 per month, the total disability income in all companies, including commercial accident and health insurance, not to exceed 50 to 60 per cent. of the applicant's income in any event.
(3) Asking for additional information in the application, as to disability or commercial accident and health insurance being carried or applied for and the approximate yearly income of the applicant from his principal occupation, excluding investment income.

We feel that this additional information far more than offsets any extra risk of fraud that we are running. In fact, we have found the additional information obtained from such questions so valuable that we are about to include some of these questions in our application blanks for the life insurance where regular disability is desired. The occupation of clergyman, mentioned by the author, is one which we exclude in issuing this special Disability provision.

An analysis of our business indicates that we are selling double the amount of business to lawyers, doctors and dentists, as compared with business before this clause was issued. Furthermore, we do not expect many claims that would not be eligible under the regular disability, as I believe that the majority of cases which might be brought into court would be decided by the court upon the basis of whether the insured could *substantially* perform the duties of *his* occupation or not. I might also mention that our agents are trained to solicit only the new Disability clause in canvassing this business, so that from a practical standpoint the man really does not have the choice as between our two Disability clauses. In a great majority of these cases, the amount of our disability income is far less than 50 per cent. of the earnings of the applicant from his occupation and it has resulted to date in giving us some additional life insurance upon a group of lives which might be classed as "preferred" for life insurance.

From our own experience in both Double Indemnity and Disability, I am of the opinion that over-insurance of these features is as important as, if not more important than, any single feature in connection with selection, especially from a monetary standpoint.

(ORAL DISCUSSION.)

MR. J. D. CRAIG:

Mr. Laird's paper is very complete and, as Mr. Flynn has said, very valuable, and, agreeing with the great majority of statements made, I don't want anything that I say construed as lack of appreciation of the paper.

In the life insurance business the science has reached a higher state of development than in the accident and health business, and, with the life companies embarking in the health business, any paper along this line that will set the actuaries thinking must undoubtedly be of great value.

There are one or two points that I wish to mention in connection with the paper. First, in regard to the commercial accident and health policies. It is stated here that out of every dollar received forty-five to fifty-five cents will go back to the policyholder approximately, and fifty-five to forty-five cents for expenses and commissions. In our office there is a very distinct feeling that

sooner or later any business that collects forty-five to fifty-five cents in order to return about the same is doomed to criticism. On page 379 there are four reasons brought out why this condition must of necessity prevail, but with these we are not in full sympathy. The company with which I am connected has embarked in the commercial accident and health business. Radical departures have been made with the idea in mind of changing some of the conditions. Premiums for health insurance have been graded according to age; the life insurance practice of paying a first-year and renewal commission followed, and while it may seem rather anomalous to write as a cancellable one year term policy a contract that is constructed upon the lines of a term policy expiring at age 60, nevertheless that is exactly what has been done. A small reserve will be accumulated, which in case of forfeitures or cancellation is not needed and provides a latent source of profit. By having the premiums increase with the age, and by paying first-year and renewal commissions, an experience similar to that of life companies is hoped for in regard to both persistency and expense, and it is believed that a loss ratio considerably higher than 55 per cent. can and will be experienced.

Statistics of the business are also being kept along the lines followed by life companies, so that as years go by the company hopes to have—and I dare say other companies will then have—available statistics;—thus remedying the situation pointed out on page 380 to the effect that no attempt has been made to trace the experience by policy year.

Naturally going into the accident and health business, the company was compelled to also write the non-cancellable policy. In fact this seemed the only logical form of policy for a life company to write, with all the life experience being on this theory.

The statement as regards accidental deaths on page 384 that "if unfavorable court decisions on borderline cases should lead to a gradual extension of the accidental death coverage," is theoretical; but is it really practical? Decisions are being rendered against companies every day, and they simply adapt themselves to circumstances and go on.

Waiting periods are included in the non-cancellable policies, but the fundamentad question is, What is the object of insurance, if not to cover all sickness? Should we not consider the real benefit, and if possible prepare rates and provide in the underwriting so that one hundred per cent. insurance can be really given? Our company has tried to do this, and only apply the waiting period when a man elects to exclude the early periods of his sickness.

As regards accident and health insurance with life contracts, we fully agree with what Mr. Laird has written and what Mr. Flynn has said.

On page 394 Mr. Laird says,

> "The disability benefits granted in conjunction with life

insurance differ materially from Commercial Accident and Health insurance, but closely resemble Non-Cancellable policies."

They not only resemble, but *are,* and the experience stated is such as to cause some concern over the general situation. Mr. Laird's thought that some table other than Hunter's should be taken as a standard in preparing rates for this contract offers one suggestion which many companies should follow.

The whole problem is still in its infancy, and a thorough discussion of the subject before the Actuarial Society is most welcome, and we thank Mr. Laird for his paper.

MR. E. W. MARSHALL:

It is important to find out how much disability coverage the applicant already has in other companies. The company with which I am connected secures this information by the use of additional questions in the application blank. The applicant is asked to state the amount of life insurance carried with disability provision, together with the amount of the disability benefits per month thereunder; also to state the amount of accident and health insurance carried. Similar questions are asked regarding new insurance applied for or pending in other companies. On the back of the application the agent is asked to estimate the applicant's annual earnings exclusive of income from investments, and to state the approximate amount of the applicant's financial worth. These figures are checked up with those given in the Inspection Report. Although we realize that this information is not entirely reliable, we believe that it is much better than nothing and enables us to determine in some degree, whether the applicant is obtaining too much disability coverage in proportion to his earnings.

We wish that other companies would follow a similar course, because all the companies are subject to the risks incident upon excess disability coverage, and if some companies do not take the precautions outlined above, the applicant may obtain too much disability coverage and all the companies carrying the insurance suffer equally.

Recent Mortality.

BY

HENRY MOIR.

Mortality is the most fascinating study for the actuary and its importance is supreme for the statesman, since the welfare of any nation is closely interwoven with the health and life of the people.

From a mathematical standpoint there seems to be an infinity of possibilities in developing new methods, and thereby getting additional light on a subject where so much yet remains undiscovered, while the fundamental facts to which the mathematics are applied are ever changing as if it were intended that there should be a continual flowing adjustment which it is our duty to watch and to study.

There is one element in American life insurance which has remained fixed and rigid for years in official use, namely,—the basis on which our premiums and comparisons are made—the American Experience Table. We must use this table under the law, although it does not represent in the least degree, or even approximate to, modern mortality conditions. Nevertheless, we have to bring our ideas into conformity with the conditions of our policy contracts, and therefore accustom ourselves to a comparison of our actual mortality experience with the expected by the old American Table. That Table forms the chief basis of our gain and loss exhibit; it measures the mortality profit from year to year so far as the public and the official supervisors are concerned; and, so long as the true condition is kept in mind by the expert, a fair interpretation of the mortality trend can be obtained from such comparisons.

It is perhaps unfortunate that in the minds of many intelligent men the prominent feature of life insurance mortality is the small proportion which actual claims bear to the expected. They frequently get an erroneous idea as to the profits of the business, even to the extent of considering that if a company experiences 60 per cent. of the expected mortality it follows that the premiums are 40 per cent. too high, a false impression which has caused much trouble in the past and may cause more in the future. We actuaries

of course know that a 40 per cent. lower mortality rate represents a much smaller proportion of premium gain—less than 20 per cent.; and we know further that such gain as is made in this way goes back to policyholders in one form or another. In the case of participating companies, a large portion of the dividend, or premium abatement, is earned by such savings in the mortality cost, while the non-participating companies in recent years have been basing their premiums upon tables which more nearly approximate to the true mortality, notwithstanding the fact that their reserves must be computed by the American Experience Table.

The actuary of a company should keep in very close touch with the mortality experience, and this can be done in a simple way through a record of the death claims as they come in. The actual death rate is sporadic and uneven, but the expected mortality is not subject to much fluctuation. It is affected by the lapses and the new business, yet at the beginning of each year the actuary may make a good approximation to the expected mortality for each month of the coming year, close enough to keep in touch with the trend of events. If for any particular reason a change may seem desirable, the figures may be modified at any time during the year. If the death claims as they are reported are recorded, and the reserves on such policies deducted from the claims, it is possible to tell with satisfactory accuracy how the mortality for the year is progressing. Seasonal mortality is an interesting influence, and in general it will be found that the claims for January, February, March and April represent a good deal more than one third of the claims for the year. Moreover, in comparing the month of February it is desirable (in the interest of accuracy) to express the expected deaths for the reduced number of days in that month.

For purposes of observation the deaths as reported form the most convenient basis, and the result is sufficiently accurate. Yet in following this course, a short month like February may be affected still further if the last day of the month falls on a Sunday. Such refinements are occasionally brought forcibly to the attention through a large number of death claims being reported on a Monday morning beginning a new month.

The following card can be completed in the Claims Department with a minimum of trouble, yet it conveys to the officers of the company a clear guide as to the mortality trend:—

DEATH LOSSES REPORTED.

Month of August							January 1st to Date			
Date		Pols	Loss Incurred				Pols	Loss Incurred		
1922	1 to 31	64	Amount	120,240	99		507	Amount	1,165,662	76
			less Reserve	40,784				less Reserve	434,808	
				79,456	99				730,854	76
1921	1 to 31	54	Amount	96,531	58		502	Amount	1,112,525	86
			less Reserve	39,734				less Reserve	378,598	
				56,797	58				733,927	86

Greater than previous year, $.....

Less than previous year, $3,073.10

The foregoing card (with accurate figures inserted) shows the month's losses to date for the current year and for the preceding year; also the year's losses from January 1st to date. It should be supplemented, on the part of the actuary and other officers who are watching this phase of the business, by a monthly card extending back over several years and containing the experience of each month in each year. When the information is inserted at the end of each month it is only the work of a minute to compute the ratio of actual to expected mortality for the month and for the year to date. These figures can be inserted for each month as the year progresses.

Some minds are so constituted that it is not desirable to indicate fluctuations in mortality from day to day or even from week to week, because two or three claims of large amount coming in together have quite a depressing effect, while on the other hand a spirit of undue optimism may arise if the mortality experience of a week or two in succession approaches zero—which occasionally happens even in a company of considerable size.

A complete analysis should be made at the end of each year, carefully conducted and summarized so as to answer those questions which an intelligent executive wants to know about the company. One of the most important elements in the success of a life insur-

ance company is the selection of risks. A mutual company is like a club, and much care is necessary to see that the members who are admitted are entitled to its privileges and are of harmonious disposition and of homogeneous class. Accordingly the executive wants to know:

I. *Selection:*
   1. If the company's selection is good;
   2. If there is any particular class that is proving unsatisfactory;
   3. If the selection is as careful as that of other good companies;
   4. If the advantages of medical examination can be traced, and if so how and when such advantages disappear;

II. *Dividends:*
   5. If the dividend factors yield rough justice to members in surplus distribution;

III. *Underwriting:*
   6. If the efforts of the company in securing new business are directed into the most profitable channels;

IV. *General Information:*
   7. If improvements can be introduced in medical selection;
   8. If steps should be taken to bring about better sanitation and health conditions on the part of public officers through educational campaigns, etc.; and
   9. If the trend of mortality from year to year is maintained in the right direction.

The above are confined to general principles which may be, and should be, studied by the actuary of every company, large or small. There are many other important questions which the larger companies should investigate annually, such as the mortality in each state, or even in each agency, by approximating roughly to the expected claims and accurately analyzing the actual death losses. This may be done occasionally in companies of even moderate size through combining the experience of several years, and thus valuable information on the subject can be obtained. The figures for any individual year are likely to be misleading and should therefore be read with intelligence.

Then, again, companies which are doing a sub-standard business should analyze such business from time to time so as to check up their system of ratings—especially to see that the entire sub-standard business as one group is giving reasonable promise of equity as between different classes.

Apart, however, from these detail matters which may be subject to special investigations and which the Hollerith System should be designed to cover in the larger companies, the more important general principles outlined above may be obtained by yearly analyses of the mortality through group valuation systems even without the powerful aid of Hollerith cards. Results of this character are illustrated in the following table, which contains actual figures as experienced by a company of moderate size:

1921 MORTALITY EXPERIENCE.

REINSURANCE NOT DEDUCTED.

	Amt. Exposed to Risk.	Expected Mortality.	Actual Mortality.	Percentage Actual to Expected.
1. *By Duration. All Classes:*				
Over 5 Years	$62,280,619	$934,559	$601,578	64.4
5th Year	11,957,717	131,578	60,448	45.9
4th Year	14,812,013	165,305	85,900	52.0
3d Year	22,395,712	241,577	115,332	47.7
2d Year	30,855,507	315,618	109,374	34.7
1st Year	31,358,520	308,923	124,567	40.3
Total	173,660,088	2,097,560	1,097,199	52.3
2. *By Class. All Durations:*				
Cont. Pay't. Life	63,814,370	887,595	545,019	61.4
Ltd. Pay't. Life	76,079,251	836,817	412,914	49.3
Endowment	15,546,848	177,170	74,395	42.0
Term (Except Ext. Ins.)	16,858,388	182,058	49,926	27.4
Extended Ins.	1,361,231	13,920	14,945	107.4
Total	173,660,088	2,097,560	1,097,199	52.3
3. *By Class. Duration Over 5 Yrs.:*				
Cont. Pay't. Life	19,364,980	377,170	299,679	79.5
Ltd. Pay't. Life	31,781,668	417,496	247,692	59.3
Endowment	5,470,632	71,731	30,552	42.6
Term (Except Ext. Ins.)	4,302,108	54,242	8,710	16.1
Extended Ins.	1,361,231	13,920	14,945	107.4
Total	62,280,619	934,559	601,578	64.4
4. *By Class. Duration Under 5 Yrs.:*				
Cont. Pay't. Life	44,449,390	510,425	245,340	48.1
Ltd. Pay't. Life	44,297,583	419,321	165,222	39.4
Endowment	10,076,216	105,439	43,843	41.6
Term (Except Ext. Ins.)	12,556,280	127,816	41,216	32.2
Total	111,379,469	1,163,001	495,621	42.6

The year 1921, to which the foregoing figures apply, may probably be viewed as one of fair average conditions—good, perhaps, but not more so than the modern spirit of progress considers proper. It may justly be suggested that the figures for one year are subject to accidental fluctuations and are not valuable. There is much truth in the criticism, but when a system like this is kept regularly in operation the figures for a period of years can be brought together at any time. Thus the average percentage mortality by duration for ten years has been as follows:

Average Mortality of 10 Years—1912–'21—including Influenza Years.

1st year	49%	of	Expected	Am.	Experience
2d year	44%	"	"	"	"
3d year	56%	"	"	"	"
4th year	58%	"	"	"	"
5th year	71%	"	"	"	"
6th year and over	75%	"	"	"	"

This average for ten years was seriously affected by the epidemic commencing October, 1918, which brought about a very high mortality at young ages, and this meant also a high mortality amongst policies of short duration, since the maximum mortality was experienced at an age under 30. In 1916 it was shown (*T. A. S. A.*, XVIII, 311) that for the preceding fifteen years there had been a steady improvement in longevity, or at least a notable addition to the effective years of life. This favorable trend was rudely interrupted by the so-called Influenza Epidemic of 1918–'19. If we omit those two from the ten years used to compute the above average, the figures are more in accord with favorable modern conditions as follows:

Average of 8 Years—1912–'21—excluding Influenza Years.

1st year	38%	of	Expected	Am.	Experience
2d year	40%	"	"	"	"
3d year	45%	"	"	"	"
4th year	54%	"	"	"	"
5th year	65%	"	"	"	"
6th year and over	72%	"	"	"	"

The first year's mortality is obtained by including all those deaths that took place during the calendar year, and which

occurred while the policy was running in its first policy year. The expected deaths were computed to harmonize with this basis, and accordingly we obtain proper mortality for comparison during the first and subsequent policy years.

When we come to consider the mortality by classes we find figures which do not always agree with preconceived ideas. The figures for the particular year 1921 show that Endowment mortality is more favorable than that of Limited Payment Life; but the opposite condition held in the preceding year and the figures do not prove this definite tendency. For more than twenty years I have been trying to determine in my own mind which class shows the better mortality results and have not yet reached a final conclusion. The difference is not great, and it is clear that both classes are decidedly better than the Ordinary Life. Probably the experience in different companies will be found to vary, as conditions are not always alike. Some companies, in their selection of risks, limit certain doubtful classes to the Endowment form, and thus introduce an element into the Endowment class which does not belong to it. For some types of hazard, especially at young ages, there are practical advantages in the course which may occasionally outweigh the theoretical objection.

In the matter of term insurance, the figures shown above are unusually favorable. A stricter selective test is applied to this class of business, which is used principally as a means of bridging over the period which so many young men experience when they recognize the need of life insurance, yet can not afford to pay for the more desirable forms. The extended insurance figures are those which one would naturally expect.

The business reinsured has not been deducted in dealing with the table printed above. The result of this handling is that there sometimes appear violent fluctuations in one particular class or duration, because of one large policy becoming a claim. This, of course, is a matter for individual adjustment when reading the figures. The results as given show the aggregate total mortality, and it is an interesting question as to whether or not it is better to show the net experience after deducting reinsurance. Of course, the net figures determine the profit or loss and appear in the gain and loss exhibit; but heretofore gross figures have been used without serious inconvenience or misapprehension.

In order to get a more general view of the mortality by classes

than is possible through the above experience of a single year, I have brought together the expected and actual claims over the ten years, 1912–'21, omitting the epidemic years, 1918–'19. As in the case of the one year, 1921, quoted in detail, the business has been divided into "under 5 years" and "5 years or more," and the following table shows the result:

Percentage of Actual to Expected Mortality—Average of 8 Years 1912 to 1921, omitting 1918 and 1919.

Class	Duration Under 5 Yrs.	Duration 5 yrs. or More.
Continuous Payment Life	56%	86%
Limited Payment Life	40	62
Endowments	38	60
Term	42	72

It may be remarked that the Term insurance in the above table includes extended insurance, because in several of the years under consideration the distinction was not drawn between Term insurance directly written and that which was obtained on discontinuance of other policies. This treatment particularly affected the percentage given in "Duration 5 years or more," and the direct issues of Term policies would probably have shown a lower figure here.

Although the figures over ten years (omitting two) seem to indicate a more favorable death rate for Endowment assurances than for Limited Payments, such figures are not conclusive, because of the fact that the Limited Payment policies contain many older lives, including paid-up policies at old ages at which the actual mortality in recent years has been found to exceed the expected by the American Experience Table. To determine the question of the relative effect of self-selection on Endowment and Limited Payment policies, we would need to analyze the mortality age by age in two homogeneous groups.

The health progress of the nation has undoubtedly been one of the causes of the prosperity of the life insurance companies in recent years. From 1914 to 1920 the crude mortality rates of the U. S. Registration Area have (with the exception of the war and epidemic years) continued to show a downward curve as generally indicated by the following:

U. S. Registration Area—Death Rates from all Causes per 1,000 Population.

Year.	Rate.	Year.	Rate.
1913	14.1	1917	14.3
1914	13.6	1918	18.1
1915	13.6	1919	12.9
1916	14.0	1920	13.1
		1921	11.7

The same feature is observed through the gain and loss exhibits of average American companies, as illustrated by the following figures of a group of ten companies confining themselves to American business:

Percentage of Actual to Expected Mortality as shown in Gain and Loss Exhibits of Ten American Companies.

Year.	Rate.	Year.	Rate.
1916	65%	1919	61
1917	56	1920	58
1918	89	1921	49

The two foregoing schedules are in continuation of those given in *T. A. S. A.*, Vol. XVIII, pp. 313, 315, but without graduation or adjustment.

Since the epidemic may be viewed as one of the evil effects of war, we may hope that its period of virulence has now gone and will not return—accordingly the years 1920, 1921, and 1922 to date may be considered as representative of modern conditions. But we must be very careful that we do not misinterpret these figures and view them in a spirit of undue optimism, because they appear on paper to be much more favorable than conditions warrant.

The years 1918–'19–'20 were not only years of epidemic, but they were also "boom" years from a business standpoint, and witnessed a tremendous increase in the amount of new business written. This has a favorable influence on the figures in the gain and loss exhibit from two different viewpoints: (1) the effect of medical and other selection, since the business then written is not yet four years old; and (2) the influence arising from the nature of the American Experience Table which shows relatively high mortality rates at the younger ages. If the average entry age were 35, the expected deaths by the American Experience Table would be nearly 8.9 per 1,000; but we know from the more recent AM[5] Table that the death rate per 1,000 at age 35, even after the chief effects of

medical selection are presumed to have disappeared, is only 4.8 per 1,000. It follows that a large introduction of new business lowers the average age of the entire body of policyholders and produces figures which appear more favorable than those of previous years, although they may be no better in actual fact or even slightly worse. It is when we try to form accurate conclusions on points of this character that we appreciate the awkwardness and unsatisfactory nature of the American Experience Table.

During the current year, 1922, the mortality experience of the average American company seems to be running just as favorably as it did during 1921. The figures of eleven companies for the months from January 1st to August 31st have been brought together. They represent expected claims of over $7,000,000 per month and the business is well distributed. The figures, therefore, are probably good average figures for the country, as follows:

Percentages of Actual to Expected Death Losses during 1922 by Months. Eleven American Companies.

	Per Cent of Legal Standard Tables.
January	52
February	64
March	71
April	56
May	58
June	49
July	41
August	42
September	40
Total for year to Sept. 30th	52

The seasonal influence is quite marked. In March only one company out of eleven showed a percentage mortality less than 60 per cent., and in July and August only one company showed a percentage above 50 per cent.; while in each of these two months no less than six companies showed percentages under 40 per cent., and seven companies averaged less than 40 per cent. for the months July and August.

Plans were made during 1921 for a comparison of the actual mortality with the expected by the American Men Table. This is the latest experience of a general nature, and it gives death rates for the period 1900 to 1915. It probably represents average modern conditions. Since the American Men Table is the experience of a

group of companies, an individual company may by careful selection secure more favorable figures, and this result is shown by the following general ratios relating to the 1921 business. In the case of policies less than five years in force, the ratio of actual to expected mortality, the expected being computed by the American Men Ultimate Table, was 65 per cent. during 1921. In the case of business more than five years old the corresponding ratio was 81 per cent.

Such ratios for a single year might not be considered of much value, standing by themselves, but they confirm, and are confirmed by, other investigations. Moreover, the trend of events would indicate that the year 1921, though favorable, was not exceptional when we bear in mind the large volume of new business of the years 1919 and 1920; and as the years pass on, we can add to the statistics and gradually reach conclusions which avoid these doubts.

It is hoped figures relating to the mortality during each of the first five years as compared with the American Men Select Table will soon be available, but in addition to the aforesaid general examination the writer was curious to find out whether the ratios were reasonably uniform at all attained ages. Accordingly the ratios of the actual to the expected were taken out in quinquennial age groups as follows:

1921 Mortality Experience by Attained Age—Comparison of Actual Claims to Those Expected by the American Men Ultimate Table.

Ages.	Duration under 5 Years.	Duration over 5 Years.
Under 25	62%	50%
25 to 29	52	61
30 to 34	59	35
35 to 39	74	66
40 to 44	52	114
45 to 49	76	65
50 to 54	40	46
55 to 59	91	60
60 to 64	86	123
65 to 69	82	79
70 to 74		154
75 to 79		115
80 to 84		79
85 to 89		62
All Ages	65%	81%

The above table shows fluctuations which are clearly accidental —a feature which must arise when dealing with a single year, and

especially when the claims for individual ages are influenced by variations in amounts. One additional claim of maximum amount would increase one of these group figures about 20 per cent.

The amount exposed to risk at young and at old ages is relatively small; accordingly it was thought desirable to group the above table in larger sections so as to observe a general trend if possible, with the following result:

Ages.	Duration under 5 Years.	Duration over 5 Years.
Under age 35	58% of AM(6)	42% of AM(6)
35 to 49	67	82
50 to 64	66	75
65 and over	82	104

It is also desirable to know how the Select Experience from year to year after issue compares with the Select Experience under the American Men table. The following figures indicate the condition in this regard as covering the business of 1921.

Comparison with American Men Select Table.

Duration	Expected Deaths	Actual Deaths	Percentage Actual to Expected
Under 1 year	122,021	124,567	102
1 to 2 years	168,836	109,374	65
2 to 3 years	141,235	115,332	82
3 to 4 years	101,861	85,900	84
4 to 5 years	85,465	60,448	71
Over 5 years	742,297	601,578	81
Total			81%

It is very pleasing to observe that the ratio remains close to 80 per cent., and, if the first two years be combined, this ratio is also maintained for those two years. An analysis of the first year's mortality indicated a somewhat high average claim rate.

A large proportion of the surplus earnings in life insurance companies is derived from so-called mortality profits, the experience for the last 20 or 30 years having shown a favorable progression, and the basis of calculation—the American Experience Table—being quite unsuited for such accounting. But we have found that the great gains are not uniform at all ages but are confined chiefly to ages under 50, a large proportion of the mortality profit of life insurance companies being made by those policyholders who are less than 45 years of age.

The more consideration given to questions of this character, the more clear it becomes that the American Experience Table is a most unsatisfactory measuring rod for many of the purposes to which we apply it. In making mortality comparisons like those given on pp. 412 to 417, the figures to the outside public appear almost grotesque in the smallness of the ratios, and it is only when they are read by trained experts that they derive any real meaning. But this is only a minor phase of the situation, for with the American Experience Table it is difficult to render justice to policyholders as between different classes and different ages; all the more so when we bear in mind the fact that the American Men Table, or any table following modern mortality conditions, would necessitate entirely different reserve values from those which we now carry, while the loadings in premiums would also be radically changed.

Discussion of Preceding Paper.

(written discussion.)

MR. M. A. LINTON:

Mr. Moir's interesting paper again brings forcibly to our attention some of the weaknesses of the American Experience Table as a measuring rod of the mortality now being experienced among insured lives. When however we try to find an alternative table our path is not entirely clear. For one thing, all of the trouble is by no means due to the American Experience Table as such; but to the fact that we are attempting to use a non-select form of table. If we are ever to arrive at the position where a uniform percentage of the cost of insurance will distribute mortality savings in accordance with experience, then a select table, with corresponding premiums and reserves will be needed. The practical difficulties however of adopting a select table are quite real, and I imagine that it would require much persuasion to bring actuaries and legislatures to the point of doing so.

In connection with the question of employing a uniform percentage of the cost of insurance in the dividend formula, it is important to note that a verdict upon the correctness of the practice can hardly be reached without consideration of the loading in the premiums. The company with which I am connected uses a two-factor formula—mortality and interest. Sometime ago we made an investigation along the following lines: the business for several years was brought together and the loading, mortality

gains, cost of insurance, premiums, amount of insurance and expenses, were scheduled under attained ages. The expense apportionment was made by a two-factor method using premiums and amount of insurance. The deficiency or excess of loading as compared with expenses were respectively subtracted from or added to the mortality gain and the net result expressed as a percentage of the cost of insurance. A study of the percentages from age group to age group led us to feel a much increased confidence in the uniform mortality percentage in the dividend formula. It was evident that a gradation of the mortality factor would have necessitated the inclusion of a complicated loading factor. When both adjustments had been made it was doubtful whether we would have done any greater average justice than was obtained by the simple two-factor formula.

When we consider the mortality element alone, however, it is obvious that a standard of reference having the characteristics of the American Experience Table may produce results that need to be interpreted with utmost care. Take for example the mortality ratios derived from the Gain and Loss Exhibits of the various companies. If the ratio in one company is much below that in another, the average person is apt to assume that the more favorable mortality is the result of a more rigid selection of risks. This may be an utterly false deduction, as the following illustrative figures for two hypothetical companies A and B will show. Although the mortality percentage is five points greater for each attained age group in company A than in company B, nevertheless A has an aggregate percentage nine points lower than B.

Attained Ages.	Company A.			Company B.		
	Expected Net Loss.	Actual Net Loss.	Ratio.	Expected Net Loss.	Actual Net Loss.	Ratio.
	(In Thousands.)			(In Thousands.)		
Under 30....	$2,000	$ 700	35%	$ 500	$ 150	30%
30–39.....	4,000	1,600	40	2,000	700	35
40–49.....	4,000	1,800	45	3,000	1,200	40
50–59.....	2,500	1,500	60	4,000	2,200	55
60 and over..	1,000	900	90	4,000	3,400	85
Total.....	$13,500	$6,500	48%	$13,500	$7,650	57%

It may be thought that this is an unlikely state of affairs to encounter in actual experience. However that may be as regards two companies, it is almost precisely what we find in the endowment and life groups in our company during the period 1915–1921 (omitting last half of 1918) for which accurate figures are given below. In that experience it will be found that the endow-

ment mortality percentage is higher than the life percentage for each decennial age group except group 30–39, and yet the percentage for the total endowment business, using the American Experience Table is, as usual, several points below the corresponding percentage for the life business. As in the illustrative table above, the explanation of this apparent statistical contradiction is to be found in the large proportion of the experience which is concentrated at the older ages under the life business.

Here we have an admirable text for a sermon upon the dangers that lurk in statistics. The arithmetical average of the ratios, which for company A is five points above that for company B, certainly affords a better comparison of the standard of selection in the two companies than does the weighted average which for company A is nine points lower than for company B. Wherever there is a chance such as this for a variation between the arithmetical and weighted averages, we must be on our guard. In using the American Experience Table as a standard of reference and obtaining aggregate ratios for several ages and durations this danger is always present.

In connection with Mr. Moir's figures it may be interesting to record in this discussion the mortality ratios of our company on the net amount at risk for all years of issue under endowment, life and term policies during the years 1915 to 1921 inclusive, excluding the experience in the last half of 1918 when the influenza epidemic was at its height. The first part of the table shows the results using the American Experience Table to obtain the expected net loss and the latter part, the results using the American Men Ultimate Table, applied of course to the net exposure derived from American Experience reserves.

MORTALITY PERCENTAGES—PROVIDENT LIFE AND TRUST COMPANY ON NET AMOUNT AT RISK FROM 1915 TO 1921 INCLUSIVE—EXCLUDING LAST SIX MONTHS OF 1918.

Attained Ages.	American Experience.				American Men Ultimate.			
	Endowment.	Life.	Term.	All Classes.	Endowment.	Life.	Term.	All Classes.
Under 30	36%	21%	34%	34%	57%	34%	54%	55%
30–39	33	39	39	35	51	60	63	55
40–49	46	43	42	44	61	56	55	58
50–59	61	55	64	59	65	58	68	63
60–69	78	76	108	81	78	76	107	80
70 and over	128	91	91	96	130	95	93	99
All ages	46%	55%	50%	49%	61%	65%	65%	63%

The first two columns of percentages in each half of the table reveal the apparent statistical contradiction mentioned above. For

each age group with but one exception, the endowment percentage is higher than the life percentage and yet the total endowment percentage is lower than the corresponding life percentage.

Apart from this apparent reversal, the other interesting fact revealed by these figures is that the more favorable experience by age groups has, generally speaking, been in connection with life rather than with endowment policies. The total endowment percentage is orthodox—the others, with one exception, quite the reverse. The explanation would appear to be the more rigid selection of the life risks. Applicants with slight impairments have been accepted under endowment policies when they would have been declined under life policies. Where a family history may have indicated that late middle life or early old age might prove to be a critical period, there has been a limitation to the endowment form. This is probably one reason for the high endowment mortality at ages 70 and over. The term mortality, although generally speaking somewhat higher than the life mortality, would hardly be called unsatisfactory.

MR. D. E. KILGOUR:

The proceedings of the Actuarial Society are essentially of a practical character and the papers are replete with the original data drawn from the experience of individual companies. It is here, however, that the representative of the smaller company finds himself distinctly handicapped as only to a limited extent can he draw from the experience of his own company and scarcely ever can he add to the fund of original information. The mortality table is the very basis of our business and while to the outsider it may seem like a dry collection of statistics it affords, as Mr. Moir properly points out, the most fascinating study for the actuary and student. To a man, however, who has not scientific equipment it may become a very dangerous weapon and it is well that those who speak with authority like Mr. Moir should take pains to state and re-state the truths it embodies, and to stress the difficulties and dangers which may be encountered by persons who are not qualified to interpret it. Among these must be included many executive officers of life insurance companies.

The basic quantity or factor in any mortality table is "q_x" or the probability at a given age of a person dying within a period of a year. How many executives work themselves into a condition of positive alarm by the study of a company's death claims without considering in the slightest degree the company's exposure or expected losses according to the mortality table set up as a standard! It is told of one president who being faced during the absence of the manager of the company with some seemingly heavy death losses wired him to return at once and stop the death claims. It is the duty of the actuaries to educate their executives

and to bring out by tables, such as Mr. Moir employs, the elemental facts with reference to the mortality of their company.

The American Men and Canadian Men tables brought out in the most recent experience have been discussed at length both in this Society and elsewhere. It seems perfectly clear that there has been both among select and ultimate lives a diminution of mortality at the younger and middle ages. The trend is obvious and I think we can readily explain it but the question is, should we accept the figures as an absolute guide. Should we not attach some importance to the fact that these tables do not include any epidemic figures and is it fair to assume, as Mr. Moir appears to, that the influenza epidemic was caused by war conditions and that a similar visitation might not occur in more normal times? According to Mr. Moir's figures the average mortality of ten years from 1912 to 1921 including influenza years was 49 per cent. of the expected American experience for the first year whereas excluding influenza years the average was 38 per cent. In other words the mortality by the inclusion of the figures for these years was increased for the first year by 30 per cent. On the other hand the average mortality from the sixth year and after was increased by the inclusion of these years by only 4 per cent. The increase in the mortality for the first five years of issue would appear to be about 15 per cent. Accepting the relative accuracy of these figures it may be assumed that the result is due to the earlier average age of those whose policies have the shorter duration and to the fact that the influenza was particularly prevalent among the younger lives.

The question arises should we not for the purposes for which we would use these tables, increase the mortality rates at the early and middle ages in order to give weight to the experience of the influenza years. The companies actually sustained these losses and it is not by any means conclusive that such losses were accidental and that similar losses are not likely to occur again.

It may not be wholly relevant to a discussion of this paper but I should like to point out that on the Canadian side of the line there has been a tendency to use them without the necessary modification for the calculation of Non-participating rates. The Dominion standard for premium rates below which a company may not go without providing special reserves is the O.M. (5) rate plus $2\frac{1}{2}$ per cent. loading. Competition is carrying the companies much below this standard and the justification or rather excuse is the new mortality table. I believe there is grave danger in this and that it would be desirable to get an expression of opinion from some of our more experienced members as to the adequacy of the tables for the computation of premium rates. Fortunately in Canada we are not handicapped by the American Experience table. Nevertheless even in respect to the O.M. (5) Table which is the standard prescribed by the Dominion Insurance Act, the inci-

dence of mortality does not follow the modern trend. Should we not recognize this as a *factor* for dividend purposes. In Life contracts rough justice is done by considering mortality savings as percentages of the expected or tabular costs but in Endowment contracts especially at the younger ages we are perhaps doing an injustice by not taking into account the true incidence. As it happens, however, our standard here is more in accord with actual facts and if we err in apportioning the profit from mortality it is not to a very great extent.

The figures brought out by Mr. Moir regarding mortality in classes appear to be characteristic. Does selection alone account for the higher mortality in the continuous life class or is it due to the fact that the class probably contains a relatively larger proportion of both the large risks and the small risks and a relatively smaller proportion of the middle size risks which we know furnish the most favorable mortality? The fact that the Limited Payment Life and Endowment policies make a special appeal at the younger ages and that the mortality rates according to the tables in use are not representative at these ages but in relation to the actual mortality experience are disproportionately high, would seem largely to account for the apparent disproportion between the mortality in the Life and the Limited Payment and Endowment classes. The low mortality in the Term classes among many companies is not accidental but due in my opinion to the standard of selection adopted. The special Five Year Renewable Term policy issued for a number of years in my own company affords an illustration of this. Only the very best lives were selected for a moderate amount and a special canvass was made among the better class of professional and business men. Though no new lives have been added to the class since 1900, the favorable mortality has been sustained notwithstanding the natural adverse selection at issue, and the subsequent effect of the withdrawal of many of the good lives.

In conclusion I should like to draw attention to the effect of the non-medical business on Canadian mortality. On this I have not the right to speak with authority and I know that the companies who are doing this business have, up to the present time, shown an unexpectedly favorable mortality. A larger number of companies are doing this business than at first and the amount of insurance granted without medical examination is being increased. I do not believe that even those most favorable to the non-medical business contend that in the long run the mortality will be as low as that experienced by medically examined business. It may not on the other hand be as unfavorable as some opposed to the non-medical business fear. At the same time I believe it is time to point out that liberalizing the practice of the companies in a way which may result in increased mortality is not consonant with the tendency to base premium rates upon or at least to regulate them by reference to the new mortality table.

MR. F. M. SMITH:

Mortality in the United States for the last couple of years and especially for the year 1921 was very favorable. The mortality rate in the United States registration area in 1900, not an abnormal year measured by the standards of that time, was about 17 per 1,000, while for the year 1921 it was only 11.6 per 1,000. In our Industrial Department, the decline in the mortality rate of 1921 from that of the year 1917 almost equalled the amount of increase shown during the year 1918. When the enormous number of deaths due to the influenza epidemic in 1918 is considered, together with the fact that the reduction in the claim rate in 1921 almost equalled the increase during 1918, the remarkably low claim rate for 1921 can be appreciated. Mr. Moir well points out we must not be too optimistic of the continuance of this very favorable mortality.

This is especially so, if the influenza epidemic of 1918 and 1919 is considered a factor in the low mortality, as the experience in our Industrial Department would seem to indicate. Undoubtedly, the death rate among insured in impaired health was heavier from influenza than among the healthy risks. If this were so, the death rate would be reduced for a time after the epidemic as it would give results similar to selection of new applicants. That the effects of the influenza would last for any number of years after the epidemic is surprising, and yet, this seems to be the fact as shown by the mortality figures of our Industrial Department.

The decrease in the claim rate in the Industrial Department of 1921 over 1917 is greatest where the influenza affected us most in 1918. The influenza death rate was heavier among males than females and in 1921 the male rate showed a larger decline than the female rate. The excess of the 1918 rate over the 1917 rate was greater among colored lives than white lives at ages under twenty, but less for older ages. Compared with 1917, the 1921 colored rate declined more than the white rate at ages under twenty but less for older ages. The greatest decline in 1921 occurred around age 34 and it is in the vicinity of this age that the influenza affected us most.

In getting our mortality experience on our Ordinary business by groups of years of experience an interesting fact was disclosed. Based upon the Compound Progressive table of the New York Life, which is a select table and allows for lower mortality in the early years, the mortality for the six years from 1910 to 1915 inclusive, is practically identical with the mortality for the six years 1916 to 1921 inclusive, the figures being based on regular Ordinary policies.

TABLE SHOWING PERCENTAGE OF ACTUAL TO PROBABLE CLAIMS BASED ON THE COMPOUND PROGRESSIVE TABLE.

Years of Experience	Percentage of Actual to Probable	
	No.	Amount
1910 to 1915	85	81
1916 to 1921	86	81

The mortality experience of 1921 on regular Ordinary policies according to age, subdivided as to business within the first five calendar years of issue and older business, is instructive. The following table subdivides the experience of 1921 according to age group for business during the first five calendar years and older business.

DEATH RATE PER 1,000 POLICIES AT RISK IN 1921.

Attained Age Group.	First Five Calendar Years.	Total excluding First Five Calendar Years.
20–24	2.14	2.96
25–29	2.42	2.61
30–34	2.47	2.95
35–39	3.42	3.48
40–44	4.41	4.97
45–49	5.60	7.56
50–54	7.97	10.00
55–59	11.48	16.07
60–64	16.98	26.69
65–69	23.81	37.45
70–74		60.93
75–79		93.20

These death rates cover one year's experience only and have not been graduated, but in their unadjusted form it is shown that the mortality of business in the first five years of issue is but little better than on older business at the younger ages. Probably the most striking similarity is on age group 35 to 39 where the death rate was 3.42, during the first five years and only 3.48 after five years. Next to this is the remarkably low death rate at the younger ages, both during the first five years and thereafter, where even after five years, the mortality through age group 35–39 is less than 3.50 per 1,000.

Mr. Moir uses as an index of the trend of the mortality by months, the approximate ratio of actual to expected mortality on the net amount at risk. Another index that might be more readily understood by Officers who are not Actuaries, is the death rate per $1,000 exposed. By comparing the figures for the current and previous years, the trend of the mortality rate can be readily seen,

and as the distribution of exposure is about the same for two or three consecutive years, this would be a fairly reliable index.

A table is included in Mr. Moir's paper showing the percentages of actual to expected death losses during the year 1922 by months. The March ratio is the highest, but the seasonal influence of mortality shown by these ratios, especially by the March ratio, is somewhat affected by the mild epidemic of influenza which reached its maximum intensity in March.

MR. J. S. ELSTON:

In Volume XI of the *Transactions,* Mr. Messenger gave various results obtained along the lines which Mr. Moir describes, the main differences being that The Travelers experience was, of course, based on the American Experience table only and was also more fully on the Calendar Year basis. I am sure that the error in the total experience due to our method is not greater than 1 per cent. even when based upon the A. M. Select table. We have applied a double interpolation to the q_x columns both to allow for the exposure during each Calendar Year commencing at half ages and also to allow for the different Policy Years in the same Calendar Year. The error, if any, in the results on the American Experience table would not be nearly as great as under the A. M. table.

Our 1921 experience corresponding to that given by Mr. Moir is shown in the following table based on the American Experience and American Men tables.

The above shows that this experience is very similar to Mr. Moir's, the main difference being on the Term Insurance and Extended Term.

One of the objects of Mr. Moir's paper appears to be to determine the relation between the results on the American Experience table and those on the A. M. table. I regret that the time was too limited to work various ratios which could be easily obtained from our experience. We have our complete experience from 1910 to 1921 on issues of 1866 to 1921 worked on this method on both tables and also similarly analyzed by the principal policy forms. The following is a summary of the ratios by Calendar Years of the expected on the A. M. table to that on the American Experience table, covering our experience during the years 1920 and 1921 and also on the two years combined.

In the above ratios it should be remembered that this is by Calendar years. Policy year 1 would lie between calendar years 0 and 1, more closely approaching Year 0 because of the necessarily larger exposure in Year 0 than in Year 1.

SURANCE NOT DEDUCTED.

	Mean in Force.	Expected.		Actual.	% Actual to Expected.	
		Amer.	A. M.		Amer.	A. M.
1. By Duration—All Classes						
Over 5 Years	336,572,157	5,376,498	4,399,911	4,036,615	75.1%	91.7%
5th Year	81,758,816	893,385	562,722	400,003	44.8	71.1
4th "	104,486,825	1,107,819	653,913	330,487	29.8	50.5
3rd "	220,853,531	2,199,234	1,195,320	961,293	43.7	80.4
2nd "	269,989,851	2,588,628	1,175,734	803,946	31.1	68.4
1st "	118,362,975	1,121,518	434,682	248,800	22.2	57.2
Total	1,132,024,155	13,287,082	8,422,282	6,781,144	51.0	80.5
2. By Class—All Durations						
O. L.	294,760,729	4,061,809	2,814,485	2,517,901	62.0	89.5
20 P. L.	354,466,338	3,890,877	2,403,683	1,736,883	44.6	72.3
20 End.	90,762,452	939,187	559,167	440,786	46.9	78.8
Term	201,160,760	2,018,448	1,050,306	811,347	40.2	77.2
Ext. Term	7,605,011	84,310	56,972	49,789	59.1	87.4
Paid-up	2,001,000	96,016	90,824	96,732	100.7	106.5
Miscellaneous	181,267,865	2,196,435	1,446,845	1,127,706	51.3	77.9
Total	1,132,024,155	13,287,082	8,422,282	6,781,144	51.0	80.5
3. By Class—Duration Over 5 Years						
O. L.	87,141,702	1,767,874	1,548,498	1,449,491	82.0	93.6
20 P. L.	117,536,318	1,709,170	1,362,591	1,136,893	66.5	83.4
20 End.	31,195,129	391,654	293,727	218,050	55.7	74.2
Term	27,711,639	302,748	205,809	283,236	93.6	137.6
Ext. Term	5,334,969	63,277	45,708	31,714	50.1	69.4
Paid-up	1,945,377	95,377	90,403	96,732	101.4	107.0
Miscellaneous	65,707,023	1,046,398	853,175	820,499	78.4	96.2
Total	336,572,157	5,376,498	4,399,911	4,036,615	75.1	91.7
4. By Class—Duration Under 5 Years						
O. L.	207,619,027	2,293,935	1,265,987	1,068,410	46.6	84.4
20 P. L.	236,930,020	2,181,707	1,041,092	599,990	27.5	57.6
20 End.	59,567,323	547,533	265,440	222,736	40.7	83.9
Term	173,449,121	1,715,700	844,497	528,111	30.8	62.5
Ext. Term	2,270,042	21,033	11,264	18,075	85.9	160.5
Paid-up	55,623	639	421	—	—	—
Miscellaneous	115,560,842	1,150,037	593,670	307,207	26.7	51.7
Total	795,451,998	7,910,584	4,022,371	2,744,529	34.7	68.2

RATIO OF AMERICAN MEN SELECT TO AMERICAN EXPERIENCE EXPECTED DEATHS—BY AMOUNTS.

Calendar Year Risk.	Year Risk 1921.	Year Risk 1920.	Year Risk 1920–1921.
0	38.8%	38.5%	38.6%
1	45.4	45.7	45.6
2	54.4	55.6	54.8
3	59.0	59.3	59.1
4	63.0	62.4	62.7
5	67.7	67.6	67.6
6	71.2	70.2	70.8
7	72.1	72.0	72.0
8	73.6	73.3	73.4
9	75.1	77.3	76.1
10	78.7	78.8	78.8
11	80.4	79.1	79.8
12	80.6	81.2	80.9
13	82.8	84.0	83.4
14	85.7	84.9	85.4
15	86.5	87.4	87.0
16	88.4	88.2	88.3
17	89.3	91.1	90.2
18	92.0	91.6	91.8
19	92.6	92.9	92.7
20	95.6	95.5	95.6

Inasmuch as these ratios were obtained from the expected deaths which are entirely independent of the actual deaths, they depend entirely upon the present age distribution of each calendar year's issues now in force. Most of the causes resulting in fluctuation in the ratio of actual to expected mortality between different calendar years as well as between different companies are, therefore, largely eliminated in such ratios. Probably the average Age at Issue would cause the greatest difference between companies. The distribution of lapses would also have some effect as well as the varying proportions of insurance under different plans. I regret that at this meeting the various relations between the two tables that can be deduced from our experience cannot be more fully analyzed. Our Age at Issue has averaged about 32 years for the last 10 years. Of course, the present attained age depends upon the relative rate of lapses and withdrawals as affected by age. But I might hazard a guess that these percentages might apply to the similar American Experience results of any other company whose average age at issue did not differ materially from ours and the A. M. Experience results thereby obtained would contain an error not greater than 5 per cent. and probably not greater than 2 per cent.

(ORAL DISCUSSION.)

MR. CHARLES A. ELLIOTT:

Australia is not in a position to answer satisfactorily the nine questions which appear on page 411. Such a position represents to us the as yet unattained ideal.

We have long been accustomed to compare the actual claims with the expected claims according to the tables used in our valuation, but we do not place very great reliance on any deductions that may be drawn from the results. In my office we have gone to the trouble of preparing tables in select form from experience of lives accepted as standard; and have divided that experience further into those under whole life tables and those under endowment tables. We thought that the comparison with that table would enable us to determine whether our selection has been satisfactory; and to a limited extent, whether our selection in one case has been better or worse than in another; but we have no means whatever of forming an opinion as to whether our selection has been better or worse than that of other companies. Neither can we form any satisfactory opinion as to the effect of medical selection, seeing that so many other items of selection enter into the question besides the actual medical examination.

We have endeavored to satisfy ourselves that our dividend factors yielded rough justice to the members; and for this purpose have kept, although we do not publish, separate accounts for the different classes of policies.

The last four questions are altogether beyond us; and if Mr. Moir can furnish us with a means of answering those questions, I for one—and I am sure I am speaking for my comrades in Australia and others—will be very grateful to you and to him.

MR. E. E. RHODES:

The group of papers which we have had today is, to my mind, the most interesting group we have had in a long time; and it is unfortunate that there has not been time to consider them more thoroughly. Mr. Moir's paper is exceedingly interesting.

Mr. Moir shows that on the continuous life plan for all durations he has had a mortality of approximately 60 per cent.: and on the endowment plan practically 40 per cent. That looks like a very big difference. I suppose a good many of the non-technical men in our offices would say, "Let's push for endowments." Just as a matter of interest I took these percentages off on the twenty year endowment and the ordinary life issued at age 35, taking the mortality gains on the basis of the American Experience 3 per cent. table; and I find that, per thousand of insurance, with a mortality of 60 per cent. for life and 40 per cent. for twenty year endowment, the mortality gains amounted to $77 for the first 20 years of the life policy and $67 for the twenty year endowment.

Where, then, is the boasted superiority of the endowment policy? And wherein does the lower mortality yield larger dividends?

Mr. Moir has a good deal to say—and has had at other times—about the American Experience table, and the difficulties we are laboring under by having to use it. I am wondering whether, regardless of any mortality experience whatever, he could construct a table according to his own ideas, which would relieve us of the difficulties. If he could, I would like to see it.

MR. PERCY C. H. PAPPS:

Presumably the figures given by Mr. Moir in the last two tables which his interesting paper contains relate to the company with which he is connected, although it is not definitely stated. The previous table deals with the figures for eleven companies, and there is some danger in reading the paper that the last two tables may be assumed to also illustrate the mortality of the eleven companies.

Mr. Moir has criticized the American Experience table and drawn attention to the fact that it does not reflect present day mortality. I have been particularly struck by the figures in the last table given by Mr. Moir. He shows that under age 35 the mortality is 42 per cent. of the American Men table, after excluding the first five years of insurance; at ages 35 to 49 the mortality is 82 per cent.; at ages 50 to 64, 75 per cent. and at ages 65 and over, 104 per cent. Presumably these figures are based upon the experience of one company only during one year. That at least suggests the possibility that more extensive data would show that the actual mortality today bears about the same relation to the American Men Ultimate table as does that table to the old American Experience. It will be found that for ages 20 to 34 the ultimate rate of mortality by the American Men table ranges from about 50 per cent. to 53 per cent. of the American; for ages 35 to 49 the mortality will vary from about 53 per cent. to 82 per cent.; from ages 50 to 64 the mortality will range from about 84 per cent. to 101 per cent. and from ages 65 on there is a steady decrease in the percentage of mortality by the American Men to that of the American table.

It is truly remarkable if the present day mortality is as much better than that shown by the American Men table as the mortality of that table is better than the old American Experience, and if, furthermore, the improvement in each case is to be found at the young ages. If the American Men table had been substituted for the American Experience table at the time the experience was taken out, the improvement shown by Mr. Moir's table would, if confirmed, warrant us in again changing the basis of all our computations.

MR. H. H. WOLFENDEN:

A good deal has been said this afternoon on the question of distribution by classes and ages; and I should like to call attention to one small point, namely, the use of the crude rates of the registration area as a means of viewing the general trend of the health of the population of the United States. So far as the members of this Society are concerned it is of course quite unnecessary to make any comment on the possible unreliability of those rates. Papers such as this one by Mr. Moir, however, are of general interest, and may easily fall into the hands of amateur statisticians who do not appreciate the true situation; and for that reason I should have liked to see Mr. Moir insert at least a note of warning that those rates may not give a reliable basis for comparison.

I am the more tempted to mention this matter because there has recently been published in England, under the auspices of the Medical Research Council, by Dr. Brownlee—the Director of Statistics of that Council—a report entitled "The Use of Death Rates as a Measure of Hygienic Conditions," in which he takes up the question of comparing the mortality rates of different communities. He propounds the theory that the only proper method of comparing mortality rates for several communities is to construct a life-table for each community, and from those life-tables to take what he calls the "life-table death rate," which is simply the crude death rate of the life-table population. He entirely overlooks the fact that the stationary population of the life-table may be just as subject to the dangers of differences in age distribution as the fluctuating population of any other community. Dr. Brownlee's viewpoint was discussed very fully at the Royal Statistical Society (*J.R.S.S.*, LXXXV, p. 537, "On the Value of Life Tables in Statistical Research"); and the sound doctrine there enunciated by Mr. Yule, Mr. Elderton, Dr. Stevenson, and Mr. Henry is well worth reading.

MR. D. P. FACKLER:

I was much interested by Mr. Rhodes' remarks that the actual dollars and cents of profits do not amount to as much as would generally be supposed from the low percentage of death loss under endowments. Mr. Rhodes' comparison was made between thousand dollar policies on the endowment and the life plan, and showed more actual mortality saving on the life plan. If you make a comparison between the earnings on $100 of premium in life and endowment, the comparison is vastly more in favor of the life plan. The agent in soliciting probably finds how much a man can spend for life insurance and then endeavors to get as much insurance out of him as possible within that premium limit. If he will put that premium expenditure into whole life insurance, either ordinary or limited-payment life, the company will make

much more profit in the way of mortality than if endowment insurance be chosen. Of course gain from high interest on endowment reserves may to a certain extent offset the profit I mention. It may be well to bear in mind, however, that the true business of life insurance companies is insurance, and not the piling up of endowment reserves as a financial investment.

(AUTHOR'S REVIEW OF DISCUSSION.)

MR. HENRY MOIR:

This paper is really a continuation of one which was prepared showing the trend of mortality from 1900 to 1916, continuing that trend for an additional period of five years. I can assure Mr. Wolfenden that I would not have omitted to call attention to the liability to error and misunderstanding by using crude death rates if it were not that I fully covered the matter in the old paper. There is grave danger, as Mr. Wolfenden points out, that such crude rates may be taken to mean more than they do.

With regard to Mr. Rhodes' humor in suggesting that I form tables according to my own ideas, I would remind him that the American Experience table we have been using for so many years was constructed in just that way. There were no reliable statistics for the older ages; it was a question of what Mr. Sheppard Homans *thought* the mortality rates should be. I do think that the American Men table is a vast improvement on the American Experience Table and nearer modern conditions; for that reason I would willingly go thus far on the way toward better things. It is not yet time for us to make further investigations of mortality, but it seems desirable to make a change in our basis of premiums and reserves, because in that way we get nearer to the truth and can deal more justly with our policy holders in the distribution of surplus, and in the equities as between classes and ages. We should also acquire a much clearer view of our mortality experience from year to year than is now possible.

I have been much interested in the illustrations given by Mr. Linton, which both clarify and amplify certain phases of the situation, and show how easy it is to reach doubtful conclusions from aggregate statistics. Mr. Kilgour's discussion is also illuminating. Of course I would not approve the use of net premium rates by a true modern table, except on the basis of inserting adequate contingency loadings. It is better to use a true table, and include definite and well understood margins for contingencies than it is to use an obsolete table which provides an unknown margin and which *does not provide adequate reserves* under some circumstances.

The Adjustment of Population Returns at Infantile Ages in the Absence of Birth Statistics.

BY

ROBERT HENDERSON.

That some adjustment is necessary in the census returns for the population at infantile ages, if fairly accurate rates of mortality at those ages are to be derived, may be readily seen from an inspection of any table of population by ages based on census returns. The following table shows the estimated male population of the state of New York at ages under five as of June 30, 1910, based on the censuses of April 15, 1910, and May 31, 1900. For purposes of record and subsequent reference there are also shown the deaths at the same ages during the years 1909, 1910 and 1911.

Age Last Birthday.	Estimated Population.	Deaths.
0	97,764	43,843
1	86,619	9,917
2	94,229	4,349
3	90,718	2,510
4	86,876	1,723

It will be noted that the reported populations for the first two years of life are very low compared with those for the next three years, indicating a deficiency in the returns at the younger ages, which may be either an absolute failure to return or a transfer from those ages to the higher ages.

The same problem arose in connection with the construction of the life tables from the census returns of England in 1911. In that case birth statistics were available for a number of years and an estimate of the population for the early years of life was made from them. This estimate agreed very closely in the aggregate with the census returns for ages 2, 3 and 4 last birthday combined, indicating that, in that case, the deficiency at the two youngest ages was an absolute one and not a mere transfer. Birth returns, where available in the United States, indicate that the same thing is true

for the 1910 census returns in those states. It may therefore be assumed that the population, as estimated from the census returns, for ages 2, 3 and 4 last birthday combined, is correct in total, although subject to a possible redistribution so far as the figures for the individual ages are concerned. In order to effect this redistribution and to estimate the population for ages 0 and 1 last birthday some further assumptions are necessary. The nature of these assumptions can perhaps best be seen from an explanation of the principles on which the estimate may be made.

In order to facilitate this explanation we shall adopt the following notation: θ_x will denote the total deaths at age x last birthday during the period of observation, ${}_x\theta_x$ will denote that portion of these deaths which had attained age x during the calendar year in which death occurred, and ${}_{x+1}\theta_x$ will denote the remainder or those which would have attained age $x+1$ during that year so that $\theta_x = {}_x\theta_x + {}_{x+1}\theta_x$; also ${}_x\theta$ will denote ${}_x\theta_{x-1} + {}_x\theta_x$ or the total deaths at mean age x, λ_x will denote the number attaining age x during the period, ${}_1P_x$ will denote the sum of those living at age x last birthday at the beginnings of the calendar years of observation, ${}_2P_x$ will denote the corresponding sum for the ends of the calendar years, and P_x will denote the total number of years of life lived during the period at age x last birthday or n times the average population in that year of life where n is the number of years in the period.

Then if we neglect immigration as unimportant at infantile ages, we have, since those who attain age x during any calendar year must either die during that calendar year at age x last birthday or be living at the end of the calendar year being then age x last birthday, and those who are living at the beginning of any calendar year at age x last birthday must either die in that year before attaining age $x+1$ or else attain age $x+1$ during that year,

$$\lambda_x = {}_x\theta_x + {}_2P_x \tag{1}$$

$$\begin{aligned} {}_1P_x &= {}_{x+1}\theta_x + \lambda_{x+1} = {}_{x+1}\theta_x + {}_{x+1}\theta_{x+1} + {}_2P_{x+1} \\ &= {}_{x+1}\theta + {}_2P_{x+1}. \end{aligned} \tag{2}$$

Also ${}_2P_x - {}_1P_x$ represents the sum of the increases in population at age x last birthday during the several calendar years of observation, or, in other words, the total increase at that age during the entire period. Suppose now that for any age x

$${}_2P_x = r_x \cdot {}_1P_x; \qquad P_x = \rho_x \cdot {}_1P_x. \tag{3}$$

This leaves open for the present the question of how the values of r_x and ρ_x are to be determined for each age.
Then

$$ {}_1P_x = {}_{x+1}\theta + r_{x+1} \cdot {}_1P_{x+1}. \tag{4} $$

Applying this successively, we have

$$ {}_1P_3 = {}_4\theta + r_4 \cdot {}_1P_4 $$
$$ {}_1P_2 = {}_3\theta + r_3 \cdot {}_1P_3 = {}_3\theta + r_3 \cdot {}_4\theta + r_3 r_4 \cdot {}_1P_4, $$

whence

$$ \begin{aligned} P_2 &= \rho_2 \cdot {}_3\theta + \rho_2 r_3 \cdot {}_4\theta + \rho_2 r_3 r_4 \cdot {}_1P_4 \\ P_3 &= \qquad \rho_3 \cdot {}_4\theta \quad + \rho_3 r_4 \cdot {}_1P_4 \\ P_4 &= \qquad\qquad\quad \rho_4 \cdot {}_1P_4 \end{aligned} $$

$$ P_2 + P_3 + P_4 = \rho_2 \cdot {}_3\theta + (\rho_2 r_3 + \rho_3)_4\theta + (\rho_2 r_3 r_4 + \rho_3 r_4 + \rho_4)_1P_4. \tag{5} $$

This gives a simple equation to determine ${}_1P_4$ from the combined population at ages 2, 3 and 4 last birthday and the deaths at mean ages 3 and 4. Then by repeated application of equation (4) the values of ${}_1P_x$ for younger ages may be derived, and by equation (3) the values of ${}_2P_x$ and P_x for all the ages involved.

If we assume that r_x is the same for all values of x and put r for this ratio, and assume also that $\rho_x = r^{1/2}$ for all values of x, then equations (3), (4) and (5) reduce to the simpler forms

$$ {}_2P_x = r \cdot {}_1P_x; \qquad P_x = r^{1/2} \cdot {}_1P_x \tag{3a} $$

$$ {}_1P_x = {}_{x+1}\theta + r \cdot {}_1P_{x+1} \tag{4a} $$

$$ r^{-1/2}(P_2 + P_3 + P_4) = {}_3\theta + (r+1)_4\theta + (r^2 + r + 1)_1P_4. \tag{5a} $$

Having redistributed the population at ages 2, 3 and 4 last birthday and estimated the corrected population for ages 0 and 1, we proceed to determine the rates of mortality from the principle that the probability that a life aged x will survive to age $x+1$ may be considered as compounded of two probabilities, one that a life which attains age x during a calendar year will survive to the end of the year being then aged x last birthday, and the other that a life aged x last birthday at the beginning of a calendar year will survive until it attains age $x+1$ during that year. The first probability is, according to our statistics, ${}_2P_x/\lambda_x$, and the second $(\lambda_{x+1})/({}_1P_x)$. The compound probability is therefore equal to

$$ \frac{{}_2P_x \cdot \lambda_{x+1}}{\lambda_x \cdot {}_1P_x} = r_x \frac{\lambda_{x+1}}{\lambda_x} = p_x. $$

Hence

$$q_x = \frac{\lambda_x - r_x \cdot \lambda_{x+1}}{\lambda_x};$$

but from equations (1) and (2)

$$\lambda_x = {}_x\theta_x + r_x({}_{x+1}\theta_x + \lambda_{x+1}) = r_x \cdot \lambda_{x+1} + ({}_x\theta_x + r_x \cdot {}_{x+1}\theta_x)$$

Therefore

$$q_x = \frac{{}_x\theta_x + r_x \cdot {}_{x+1}\theta_x}{\lambda_x}. \tag{6}$$

If $r_x = r$, this takes the form

$$q_x = \frac{{}_x\theta_x + r \cdot {}_{x+1}\theta_x}{\lambda_x} = \frac{\theta_x}{\lambda_x\{1 + f_x(r-1)\}^{-1}}, \tag{6a}$$

where $f_x = {}_{x+1}\theta_x/\theta_x$. Therefore the expression for the exposed to risk at age x last birthday is on this assumption

$$\lambda_x\{1 + f_x(r-1)\}^{-1}$$

or in the general form $\lambda_x\{1 + f_x(r_x - 1)\}^{-1}$.

As an example of the application of these principles, we will take the case of male lives in the state of New York for which certain statistics have already been quoted. In addition to those given above, we will need the estimated population at ages 2, 3 and 4 last birthday combined as of June 30, 1900, this aggregate being 227,985 as against a corresponding population of 271,823 as of June 30, 1910. If then we assume that r_x is the same for all ages up to four inclusive and is determined from these combined populations on the assumption of a uniform geometrical increase, we have

$$271{,}823 = 227{,}985\, r^{10},$$

whence

$$\text{Log } r = .0076380; \quad r = 1.017743.$$

In order to complete the process we now require values of f_x for each age. The reader is referred to the recently published United States Life Tables 1890, 1900 and 1910 for a discussion of these values, and it will suffice here to say that it is proposed to use here the values there arrived at for ages one to four last birthday inclusive and to use for age zero a value based on the adjusted table of deaths in the first year of age in New York by months of age. The following table shows these values and the resulting analysis of the deaths:

Age Last Birthday.	f_x.	θ_x.	$_{x+1}\theta_x = f_x\theta_x$.	$_x\theta_x = (1-f_x)\theta_x$.	$_x\theta = {}_x\theta + {}_x\theta_{x-1}$.
0.....	.30	43,843	13,153	30,690	30,690
1.....	.41	9,917	4,066	5,851	19,004
2.....	.47	4,349	2,044	2,305	6,371
3.....	.48	2,510	1,205	1,305	3,349
4.....	.48	1,723	827	896	2,101

Then consistently with the assumption made in the construction of the United States Life Tables generally we take the estimated population at ages 2, 3 and 4 last birthday combined as of June 30, 1910, as representing the average population at those ages during the three years of observation, so that the total years of life are three times that estimated population, or

$$P_2 + P_3 + P_4 = 815{,}469$$

and

$$r^{-1/2}(P_2 + P_3 + P_4) = 808{,}330;$$

also

$${}_3\theta + (r+1)\,{}_4\theta = 7{,}588.$$

Therefore

$$(1 + r + r^2)\,{}_1P_4 = 800{,}742$$

and

$${}_1P_4 = 262{,}234.$$

The resulting estimates of population are given in the following table:

Age.	$_1P_x$.	$_2P_x$.	λ_x.	Average Population.
0.....	312,518	318,063	348,753	105,093
1.....	288,397	293,514	299,365	96,981
2.....	277,109	282,026	284,331	93,186
3.....	268,987	273,760	275,065	90,454
4.....	262,234	266,886	267,782	88,183
5.....			261,407	

For the rates of mortality we have the following:

Age.	λ_x.	$_x\theta_x + {}_{x+1}\theta_x \cdot r$.	$1000q_x$.
0.....	348,753	44,076	126.38
1.....	299,365	9,989	33.37
2.....	284,331	4,385	15.42
3.....	275,065	2,531	9.20
4.....	267,782	1,738	6.49

The same rates of mortality might have been arrived at by calculating the values of λ_{x+1}/λ_x, multiplying by r and subtracting from unity.

If in lieu of a uniform geometrical increase we assume that the population at each age increases arithmetically over the ten-year period, we find an average value of r for ages 2, 3 and 4 of 125/123. If then we take this as the value of r_3, we have consistently with the principle of arithmetical increase the following values of r_x and ρ_x:

x.	r_x.	ρ_x.
0	131/129	130/129
1	129/127	128/127
2	127/125	126/125
3	125/123	124/123
4	123/121	122/121

The equation for ${}_1P_4$ then becomes

$$\frac{372}{121}{}_1P_4 + \frac{250}{123}{}_4\theta + \frac{126}{125}{}_3\theta = 815{,}469.$$

On this basis the estimates of population and the rates of mortality are as follows:

Age. x.	${}_1P_x$.	${}_2P_x$.	Average Population.	λ_x.	${}_x\theta_x + {}_{x+1}\theta_x \cdot r_x$.	$1000q_x$.
0.....	311,267	316,093	104,560	346,783	44,047	127.02
1.....	287,732	292,263	96,666	298,114	9,981	33.48
2.....	276,930	281,361	93,048	283,666	4,382	15.45
3.....	269,204	273,581	90,464	274,886	2,530	9.20
4.....	262,760	267,103	88,311	267,999	1,737	6.48
5.....				261,933		

This investigation was suggested by the fact that the official readjustment of population at the infantile ages, although based on the assumption that the population at ages 2, 3 and 4 last birthday combined was correct in total, appeared to give a total population at those ages about one per cent. less than the original statistics, and it seemed desirable to devise a method which would not produce such a result.

Discussion of Preceding Paper.

(WRITTEN DISCUSSION.)

MR. PERCY C. H. PAPPS:

Mr. Henderson's paper should be read in connection with the description of the method used in compiling the various tables relating particularly to the 1910 census, which is contained in the volume prepared by Mr. James W. Glover entitled "United States Life Tables: 1890, 1901, 1910 and 1901–1910." The estimated population figures given at the beginning of the paper are derived from the original statistics relating to the population at April 15, 1910 and May 31, 1900. The estimate is made as of June 30, 1910. These figures may be considered as the unadjusted population returns as of June 30, 1910.

As Mr. Henderson points out in the last paragraph of his paper, it was assumed in the official readjustment of the population that the sum of the population at ages 2, 3 and 4 was correct. It was necessary to readjust the numbers at each of the three ages, so that the adjusted figures would agree in total with the unadjusted. As Mr. Henderson points out, the officially adjusted figures are somewhat less than the sum of the unadjusted. Mr. Henderson's paper shows us how we may adjust the population returns and still preserve the equality between the sum of the adjusted and unadjusted figures.

The population and deaths shown at the beginning of Mr. Henderson's paper will be found on page 450 of the official publication. On page 373 of the same volume will be found photographs of adding machine tapes used in connection with the numerical computations for male lives in the state of New York. These tapes are identified by number. On tape 142 it is shown that the exposed to risk at age 0 is based upon the sum of the births in the years 1909, 1910 and 1911. The population at each subsequent age is 1/3 of the subtotals shown on tape 145. It is interesting to compare the crude figures with those as officially adjusted and with Mr. Henderson's adjustment on the assumption of both geometrical and arithmetical increases in population. The table is as follows:

Age Last Birthday.	Estimated.	Officially Adjusted.	Mr. Henderson's Adjustment.	
			Geometrical.	Arithmetical.
0	97,764	115,555	105,093	104,560
1	86,619	98,257	96,981	96,666
0 and 1	184,383	213,812	202,074	201,226
2	94,229	93,140	93,186	93,048
3	90,718	89,911	90,454	90,464
4	86,876	87,673	88,183	88,311
2, 3 and 4	271,823	270,724	271,823	271,823

It will be noticed that the officially adjusted figures for ages 2 to 4, inclusive, are 1,099 less than the sum of the crude figures. Both of Mr. Henderson's adjustments agree with the total of the unadjusted figures. Mr. Henderson preserves this equality by first ascertaining the sum of those living at age 4 last birthday at the beginnings of the Calendar Years of observation in terms of the unadjusted population at ages 2, 3 and 4, as shown in formulae 5 and 5a.

The student, in reading Mr. Henderson's paper, should remember that of the children dying in the year 1922 at age 3 last birthday, for example, some reached their third birthday in 1922 and others would have reached their fourth birthday in that year, so that some of the children must have been born in 1918 and others, in 1919. Where the suffix on each side of the symbol θ is the same, the death has occurred after the anniversary of the birthday in the Calendar Year. Where the suffix on the right of θ is less than that on the left, the death has occurred prior to the anniversary of the birthday in the Calendar Year. The reported deaths are those for age last birthday during the period covered by the investigation. It is necessary to divide the deaths according to the year of birth. The percentages for age last birthday 1 to 4, inclusive, will be found in table 109 on page 340 of the official publication. Mr. Henderson states that the value which he used for age 0 last birthday was based on the adjusted table of deaths in the first year of age in New York by months of age. The value used .30 is slightly larger than the percentage shown in table 109 above referred to, which is .28.

The derivation of the formulae used by Mr. Henderson suggests the possibility of an extension to older ages whereby the adjusted figures would depend upon the recorded population for five age periods. If the record of the deaths was reasonably free from error, it would seem that Mr. Henderson's method might be used to redistribute the population, which is necessary on account of the well-known tendency to state the age of the living in multiples of five years.

Mr. Henderson has given us a very interesting paper dealing with a subject which has always proved troublesome to statisticians; namely, the adjustment of population returns at infantile ages.

(AUTHOR'S REVIEW OF DISCUSSION.)

MR. R. HENDERSON:

With reference to Mr. Papps's very interesting and instructive discussion it is only necessary to point out that the figures which he gives for the average population as officially adjusted were apparently obtained by taking for age 0 one-third of the births and for the other ages one-third of the exposed to risk. In order that

these figures should compare exactly with those in the other columns it is necessary to deduct in the case of age 0 one-half of the increase in population and in case of all ages the proportion of the deaths which occurred before the end of the Calendar Year in which the year of age was entered upon. This adjustment gives the following results:

AVERAGE POPULATION AS OFFICIALLY ADJUSTED.

Age last Birthday	Population.
0	104,099
1	96,306
0 and 1	200,405
2	92,372
3	89,476
4	87,374
2, 3 and 4	269,222

Legal Notes.

BY WENDELL M. STRONG.

(*Member of the New York Bar*).

Payment of First Premium while Insured in Good Health: (Ansin *vs.* Mutual Life Insurance Company of N. Y., Supreme Judicial Court of Mass., 134 N. E. Rep. 350.) The policy in question was delivered to the insured on February 12th but the premium was not paid at that time, check for payment of premium being actually delivered to the agent of the company on February 19th. The insured was admittedly taken ill, with an illness which proved fatal, on February 17th or 18th and died on February 20th. The application contained the provision that the policy should not take effect unless the first premium was paid while the applicant was in good health. The company denied liability on the ground that this condition was not fulfilled.

In the suit the plaintiff offered to introduce evidence that the insured, at the time of delivery of the policy, stated that it would not be convenient for him to pay the premium until February 16th and that the agent then stated that he would pay the premium and keep the policy in force and that the policy would be in force from the time of its delivery. This evidence was excluded. The plaintiff also offered to introduce evidence that the agent called the brother of the insured on the telephone on February 16th and asked if a check had been left for the premium and was told that it had, and that the agent then asked him to hold the check until he called for it, which was agreed upon. This evidence was also excluded.

It was agreed that the insured continued in good health through February 16th and that the check was not manually in the hands of the company before February 19th, at which time the insured was not in good health.

The Supreme Court held that the evidence on both of the points mentioned above was properly excluded, since (a) the agent had no power to keep the policy in force, in which connection the court quoted the strong clause in the policy specifically providing that

the agent had no power to "extend time for payment of premiums," and (b) the keeping of the check until the agent called for it was not payment of premium in accordance with the terms of the policy. Before the illness of the insured "neither the company nor the agent had possession or control of the check; up to that time it remained in the possession of the insured or his brother and either of them could have refused to pay the premium and the defendant would have no right to collect it." Judgment was entered in favor of the company.

RECEIPT IN FULL:—(Stricker *vs.* Metropolitan Life Insurance Co., St. Louis Court of Appeals, Mo., 237 S. W. Rep. 894.) The company denied liability under a $500 policy and after the death of the insured offered in full settlement the premium paid, namely, $17.50. This the beneficiary at first refused to accept but after a month he went to the agent of the company and requested its payment, and signed a release of the company from all liability. Afterward, notwithstanding this settlement and release, he brought suit.

The court brushed aside the settlement and release as of no importance, speaking in part as follows:

"Nor is plaintiff precluded from asserting any right to recover on account of the purported release, which he signed. The liability of the defendant was fixed and determined by the provisions of the policy. Plaintiff accepted the $17.50 because defendant's agent advised him that it was all he could get. He says he accepted it because he thought it was the best he could do. We are not inclined to hold that the adjustment of a claim definite and fixed in the amount of $465 for $17.50, under the facts of this record, is conclusive against plaintiff in a direct attack thereon. The mere fact that the amount of the premiums was returned would not discharge the debt, as a matter of law, under the facts of this case, because there would be no consideration."

COMMENT.

This doctrine is peculiar since usually a receipt in full given as the result of a compromise settlement is, in the absence of fraud, valid as a bar to any further claim.

WHAT POLICY COVERS: "PARTICIPATION IN AERONAUTICS": —(Travelers Insurance Co. *vs.* Peake, Supreme Court of Florida, 89 So. Rep. 418.) The insured was injured in the fall of an airplane in which he was a passenger. He held a policy insuring

against accidental injury which contained the following exception: "The insurance hereunder shall not cover injuries fatal or non-fatal . . . sustained by the insured while participating in or in consequence of having participated in aeronautics." The court held in accordance with Bew *vs.* Travelers' Ins. Co. (*T. A. S. A.* XXII, 253) that the insured was participating in aeronautics within the meaning of the provision in the policy. It also, in the brief opinion, stated clearly the proper interpretation of an insurance contract as to risks covered by that contract as follows:

"Policies of insurance are designed to secure indemnity to the insured for losses or injuries stated in the policy, and the terms used should be so construed as to effectuate the purpose designed, ambiguous provisions being fairly construed in favor of the insured, but parties *sui juris* are bound by their valid contracts, and where a particular risk is expressly and clearly excepted from the risks assumed by the insurer, the courts have no power to enforce indemnity for losses or injuries resulting from such excepted risks, as expressed by the indemnity contract contained in the policy."

MEANING OF "CONSULTING A PHYSICIAN OR SURGEON":—(Le Grand *vs.* Security Benefit Ass'n., Springfield Court of Appeals, Mo., 240 S. W. Rep. 852.) Liability under the policy was denied, one of the grounds being a false representation that the insured had not consulted a physician or surgeon within the past five years, whereas the insured had consulted an osteopath within that time. The court held that an osteopath was not a physician or surgeon.

IS EFFECT OF MISSTATEMENT IN APPLICATION MODIFIED BY INFANCY OF APPLICANT?—(Kerpchak *vs.* John Hancock Mutual Life Ins. Co., Court of Errors & Appeals of New Jersey, 117 Atlantic Rep. 836.) The insured stated that she had never consulted a physician, whereas shortly before the application was made she had consulted physicians twice. The court held that this was material, speaking in part as follows:

"Every fact which is untruly stated or wrongfully suppressed must be regarded as material, if the knowledge or ignorance of it would naturally and reasonably influence the judgment of the underwriter in making the contract at all, or in estimating the degree or character of the risk, or in fixing the rate of premium."

It was contended that the false statement did not bar recovery by the beneficiary because the insured was an infant. The court held false statements to be a bar, speaking as follows:

"Where, as here, a policy of insurance is taken out by a minor above the age of 15 years, on her own life and for her benefit or the benefit of her mother, and she dies before reaching majority, a false and fraudulent representation made by the insured in the application upon which the policy is based, respecting a matter of fact material to the risk, constitutes a defense to an action upon the policy by the beneficiary named therein."

It is to be noted in connection with this decision that New Jersey has a statute removing, in respect to taking life insurance in favor of certain near relatives, the disability of an infant of fifteen years or more in respect to making contracts.

MODE OF SETTLEMENT AT MATURITY OF LESS VALUE THAN THE FACE OF THE POLICY":—(First Texas Prudential Insurance Co. *vs.* Smallwood, *et al.,* Court of Civil Appeals of Texas, 242 S. W. Rep. 498.) Texas has a statute prohibiting "a provision for any Mode of Settlement at maturity of less value than the amount insured on the face of the policy . . ." One of the questions involved was whether this statute applied to the present case. The policy contained a schedule giving the name of the insured, premium, weekly benefits, "principal sum," beneficiary, etc. In the provisions for various benefits for various injuries or for loss of life from accident the amount payable was specified either as the "principal sum" or some fraction of the principal sum. In another section it was specified that the amount payable for death resulting from disease should be equal to "fifteen times the weekly benefit provided in schedule below, but not exceeding one hundred and fifty dollars." Fifteen times the weekly benefit named was $75, whereas the amount named as "principal sum" was $150.

Notwithstanding the fact that the expression "principal sum" was used, the court held that the policy was not in conflict with the statute but provided for different amounts for death from disease and death from accident, and that in case of death from disease the beneficiary was entitled only to the amount provided for in case of such death, namely, $75, instead of the principal sum of $150. This would seem the only logical conclusion but the fact that there has appeared a tendency in some courts to apply similar statutes to cases which do not really come under them, makes this case of more interest.

DATE WHEN POLICY BECOMES INCONTESTABLE:—(Mutual Life Insurance Co. of N. Y. *vs.* Hurni Packing Company, Circuit Court of Appeals, Eighth Circuit, 280 Fed. Rep. 18.) The chief question involved was whether the date of the policy and the "date of issue" mentioned in the policy were the same. The reason this was a deciding factor was that the decision as to whether the company had begun its contest of the policy within two years from "date of issue" (the court holding this necessary in accordance with the Monahan case, *T. A. S. A.*, XIX, 104) depended upon it, the policy having the provision that it was incontestable after "two years from its date of issue." At the time the application was taken the insured requested that the policy be dated back a few weeks in order to give him a younger insurance age with the consequent lower premium, and in accordance with this request the date given the policy had been this earlier date. If this date were taken as the "date of issue" the two years would have elapsed before the company began its contest. If, however, the "date of issue" were taken as either the date the policy was written, the date of the medical examination or the date of the application, the two years would not have elapsed.

The court held that the "date of issue" meant the fictitious date as of which the policy was dated. The case has been appealed to the Supreme Court of the United States.

CHANGE OF BENEFICIARY:—(Marlow *vs.* Paganini, U. S. Circuit Court of Appeals, Ninth Circuit, 277 Federal Rep. 790.) The policy provided for change of beneficiary by written notice to the company at its home office accompanied by the policy for endorsement of the change, and further provided that, unless so endorsed, the change should not take effect.

The insured filed at the San Francisco branch office of the company direction to change the beneficiary but did not ever send such direction to the home office. He also did not present the policy for endorsement although he lived for over a year after the date of this direction to the branch office, the reason probably being that the policy was in the possession of an assignee.

The court held that the change of beneficiary was not effected.

CHANGE OF BENEFICIARY:—(Quist *vs.* Eastern and Southern Life Insurance Co., Supreme Court of Michigan, 189 N. W. Rep.

49.) The policy when taken out was placed in the hands of the beneficiary and she paid the premiums thereon. The policy contained a clause reserving to the insured the right to change the beneficiary. Shortly before his death the insured made application to the company to change the beneficiary to his estate, stating that he could not deliver the policy to them for endorsement. The company consented to the change of beneficiary under these conditions, and it was made, the insured afterwards surrendering the policy to the company for cash but without manual delivery of the policy to it.

The original beneficiary claimed that she had an interest in the policy and that the terms of the policy constituted a promise on the part of the company that it would change her interest only in accordance with the terms of the contract with the insured. The court held that the policy did not make such a promise and that the change was effective although the policy had not been surrendered for endorsement, which, it appears from the opinion, was required by the terms of the change of beneficiary clause.

Most of the cases where a court has decided that a change of beneficiary was effective even though the endorsement of the policy called for by its terms had not been made, were cases where the insured had done all that was required of him by the contract, including the sending of the policy to the company, but his death had occurred before endorsement was actually made. This case differs therefore in that it holds that if the company and the insured agree to dispense with the endorsement, it is not essential to the change although provided for in the policy.

Bankruptcy: Change of Beneficiary:—(Jens *vs.* Davis, Circuit Court of Appeals, Eighth Circuit, 280 Fed. Rep. 706.) The question was whether the surrender value of certain policies passed to the trustee in bankruptcy of the insured. The policies were in favor of the insured's wife as beneficiary and the insured had the right to change the beneficiary. The Iowa Code provides that a policy payable to wife or children is exempt from the claims of the insured's creditors. The court called attention to the fact that the statute did not state that the exemption was contingent upon the absence from the policy of the right to accept a surrender value or of the right to change the beneficiary, and held that the statute did, consequently, exempt such policies as the ones in question and

that, therefore, the surrender value did not pass to the trustee in bankruptcy.

DESIGNATION OF BENEFICIARY:—(Doney *vs.* Equitable Life Assurance Society of the U. S., Supreme Court of New Jersey, 117 Atlantic Rep. 618.) The insurance was under a group policy. The application named as beneficiary "Florence K. Downey, wife" and the certificate was so issued. She, however, was not the legal wife of the insured, who had a wife living. At the death of the insured the company paid the amount of the insurance to the person passing under the name of Florence K. Downey. The legal wife of the insured brought suit, claiming as beneficiary on the ground that the word "wife" designated her.

The decision of the lower court in favor of the legal wife was reversed and the case remanded on the ground that if the person who was the legal wife of the insured had been intended, the name Florence would not have been used, that the word "wife" was simply descriptive, and that the name and not the description should control.

RIGHT OF BENEFICIARY PAYING DUES UNDER FRATERNAL BENEFIT CERTIFICATE:—(Ryan *vs.* Woman's Benefit Ass'n. of Maccabees, Kansas City Court of Appeals, Mo., 237 S. W. Rep. 224.) The insured's daughter took over the payment of dues on the certificate under an agreement that she should be the sole beneficiary, and that the insured should not thereafter change the beneficiary. The home office of the order was notified that the daughter was paying the premiums. Nevertheless, after the insured was seventy years of age and only six months before she died, the order paid the insured one half of the face amount of the certificate for a release of all liabilities under the certificate. The certificate, however, was not surrendered, being in the possession of the daughter.

The by-laws of the order provided that a beneficiary should not have a vested interest and the insured should have the right to change the beneficiary. Also the statutes of the state provided that a beneficiary should not obtain a vested interest even though a contract was made with the insured that the beneficiary should pay the premiums.

The court held that the purchase of the certificate from the

insured while living was an unauthorized and illegal act, and that while the beneficiary had no vested interest but only an expectancy, this expectancy was not defeated since the insured did not do what the statute gave her the right to do, *i.e.*, change the beneficiary or revoke the certificate. It consequently held that the beneficiary had a right to relief in equity.

SUICIDE:—(New York Life Ins. Co. *vs.* King, Court of Appeals of Georgia, 112 S. E. Rep. 383.) The payment of the policy was refused on the ground that the insured committed suicide. The insured was killed by a revolver shot and the defense showed that because of disease there was a strong motive for self destruction, also that the revolver shot entered the temple, the revolver being held so close as to cause burns, and that shortly before the shot was heard the insured was sitting on the steps of the porch, the revolver lying by him on the floor of the porch, no one else being near. The plaintiff offered no witnesses or evidence to show the cause of death of the insured or how the wound was inflicted. The jury gave a verdict against the company.

The court in reversing the verdict held that in view of the circumstances "the ordinary man would have no doubt as to the cause of death, and that the insured took his life by shooting himself through the head with a pistol."

In discussing the presumptions against suicide upon which the verdict of the jury rested the court said:

"It has been repeatedly held by various courts, in discussing this question, that the issue as to the cause of death must be proved like any other fact in a civil action by a preponderance of the evidence on the question. As stated in several cases on the point, the law does not prescribe any formula by which the hypothesis of accident must be removed; it is sufficient that it is met by evidence, where there are no facts or circumstances shown indicating accident or mistake and facts and circumstances are shown which establish that the cause of death was suicide."

"There is nothing to the contrary of this conclusion except the merest conjecture, and this conjecture must yield to facts. It can only exist in the absence of such facts. Indeed if there is any evidence in the case that shows the cause of death, that evidence must prevail. As against the mere conjecture, the slightest evidence of physical facts becomes strong, even conclusive."

SUICIDE:—(Woodmen of the World *vs.* Alexander, Court of Civil

Appeals of Texas, 239 S. W. Rep. 343.) It was admitted that the company was liable unless the insured committed suicide. In the lower court, the jury, on a question submitted to it, found that the insured did not come to his death as a result of his own act. The evidence was entirely circumstantial. The insured died from hanging and, when found, was in such a position that he had to pull his feet up to avoid touching the floor, and could, it was contended, have released himself by simply putting his feet on the floor. It was also known that he had complained of being in debt and of bad financial prospects.

The Court of Civil Appeals held that the evidence all pointed toward death by suicide and that in consequence the verdict of the jury was contrary to the evidence, and reversed the judgment based thereon.

SUICIDE WHILE INSANE:—(National Life Insurance Co., of Montpelier, Vt., *vs.* Watson, Court of Appeals of Kentucky, 239 S. W. Rep. 35.) The policy provided that it should be null and void if within one year from the date of the policy "I shall suicide or destroy myself, sane or insane." The lower court in the instructions to the jury stated that they should find against the company if the insured was so insane that at the time of his act he was unable to govern his actions by reason of some insane impulse. The Supreme Court held that this was ground for reversing the judgment. In the course of the opinion the court said:

"Many courts, including this one, have construed such clauses to mean that the company is excused from payment where the insured takes his life in all cases, except where he was so devoid of mind at the time that he did not realize or contemplate the nature of his act and the physical consequences thereof. In other words, that he was so devoid of mind that he did not know what he was doing, and did not intend to commit the act which resulted in his death, and with the exception of some dictum the above has been the consistent holding of this court from the time the 'sane or insane' clause was first presented for consideration."

A similar doctrine is set forth in Columbian National Life Insurance Co. *vs.* Wood, Court of Appeals of Kentucky, 236 S. W. Rep. 562.

SUICIDE:—(Kohlman *vs.* New York Life Insurance Co., Supreme Court of Louisiana, 90 So. Rep. 132.) A verdict against the com-

pany returned by the jury was reversed on appeal to the higher court and judgment rendered for the company on the defense of suicide.

The facts were that the insured, who had often used drugs, including a solution of carbolic acid, went, during the day, from his office to the drug store for a three-ounce bottle of carbolic acid and that later he was found in his office dead of carbolic-acid poisoning. He was at the time in straitened circumstances.

The court held that there was no reasonable hypothesis to account for his taking the carbolic acid except that of suicide, for which act financial circumstances and desire to provide for his family by means of the insurance he carried might reasonably be presumed to furnish the motive.

"Result of Military or Naval Service in Time of War":—(Mutual Life Insurance Co. of N. Y. *vs.* Johnson, Court of Appeals of Georgia, 110 S. E. Rep. 910.) One of the exceptions in the Double Indemnity provision in the policy was that it should not be payable in event of the insured's death "as a result of military or naval service in time of war . . . or if such death be caused directly or indirectly, wholly or partly, by riot, insurrection, or war, or any act incident thereto."

The insured was being conveyed in a troop train to the western coast and either had his head out of a window or was standing on the steps of one of the cars when it passed over a bridge, and he struck against a girder of the bridge and was killed. The court held that the insured's death came under the exception named in the policy and that consequently the Double Indemnity was not payable.

Delivery of Policy:—(New York Life Insurance Co. *vs.* Smith, Supreme Court of Mississippi, 91 So. Rep. 456.) Among the questions involved was whether the condition of delivery of the policy during the good health of the insured was fulfilled. The soliciting agent to whom the policy had been sent for delivery saw the insured on the street, told him the policy was ready for delivery and the insured requested that he, the agent, hold the policy and he would get it later. At this time the premium had been paid. The insured died without manual delivery of the policy having been made.

The court held that the insured being in as good a state of health, when this conversation took place, as at the time of the medical examination, the transaction amounted to delivery during good health.

DISAPPEARANCE: TIME OF DEATH OF INSURED:—(Eklund *vs.* Supreme Council of the Royal Arcanum, Supreme Court of Minn., 187 N. W. Rep. 826.) This was a disappearance case and the question was whether the insured should be presumed to be dead at the end of the seven-year period of the common law or whether his death occurred within slightly over four years after he was last heard from. The jury found that the insured died before the end of the four-year period mentioned. One of the questions before the Supreme Court was whether or not there was evidence to support this finding.

The facts were that the insured, fearing his arrest for embezzlement, left his family in 1905. He wrote to his family from various places until 1911, during which time he had been in Great Britain, for a time on the eastern coast of the United States and later on the western coast, his letters from January, 1911 on, coming from several different points in Oregon. At the time of his last letter he had suffered an injury to his knee, and some of the letters in 1911 indicated that he was in a dangerous occupation. After ceasing to hear from the insured his wife wrote, from her residence in Indiana, to the chiefs of police in various places on the Pacific Coast where he had been and advertised for him in the War Cry of the Salvation Army, prosecuting her unsuccessful search for him for three years. About four years after his disappearance he was suspended for non-appearance at his local lodge after notice. The jury in response to a special interrogatory found that he died prior to this date of suspension. The Supreme Court held that the jury's finding was not unreasonable.

This is contrary to the usual doctrine that the common-law presumption of death after seven years' disappearance does not presume that death occurred at any particular time before the end of such seven years and it apparently is founded on no evidence except the fact that he failed to communicate with his family and that the family after a diligent search were unable to find him or any later trace of him.

DEPENDENCY:—(Silberstein *vs.* Vellerman, *et al.*, Supreme Judicial Court of Mass., 134 N. E. Rep. 395.) There was a death benefit provided by the constitution of the Cigar Makers Union, which was payable only to a person designated by the member, or, in the absence of such designation, to the widow, to minor children, or to relatives dependent in whole or in part upon the member. In this case there was no designation and no widow or children but there was a sister who claimed as a dependent. There was a family of five, including the deceased, two brothers, the sister who claimed as dependent and another sister, living in the one house. The claimant acted as housekeeper, all of the others being employed in gainful occupations. The deceased received the largest pay and in addition to his regular payment per week towards the support of the establishment gave money from time to time to the claimant for various purposes. The claimant had no income except what the others furnished.

The lower court held that she was a dependent of the insured within the terms of the requirement. The Supreme Court affirmed the decree in her favor.

FORFEITURE OF INSURANCE IN BENEFIT ASSOCIATION BY FAILURE OF PAYEES:—(Reichle *vs.* Perkins, Court of Appeals of New York, 134 N. E. Rep. 336.) As a member of the Cigar Makers Union the insured was entitled to certain death benefits. The constitution provided for payment to a designated beneficiary or, in case of no such beneficiary, to the widow, children, or the relatives dependent for support upon the insured, and provided that in case there was no designated beneficiary and no widow, children or dependent relatives, nothing should be payable. In the present case the insured had made no designation and there were no widow, children or dependent relatives and the administratrix made claim.

The court upheld the provision in the constitution of the union that in such a case nothing should be payable as a death benefit.

WHAT CONSTITUTES FORFEITURE:—(Lofstead *vs.* Bank Savings Life Insurance Co., Supreme Court of Kansas, 204 Pac. Rep. 530.) The policy in question had a provision that in case of death of the insured while engaged in military service without having paid the extra premium required, the amount payable should be the net

cash surrender value. The insured had so died. One of the grounds for claiming the full amount of the policy was that the provision mentioned was for forfeiture in case of nonpayment of the extra premium and that the company had waived its right by accepting the premium from the insured while engaged in military service, with full knowledge that he was so engaged.

The court held that this provision did not constitute a provision for forfeiture.

CUSTOM OF GIVING PREMIUM NOTICE:—(New York Life Insurance Co. *vs.* Lahr, Supreme Court of Indiana, 134 N. E. Rep. 657.) In 1892 a ten-payment life policy was issued to the insured. The premium due in 1898 was not paid. In 1904 the insured requested reinstatement of the policy and offered to pay the back premiums with interest, which was refused. The demand was made again in 1913 and suit was brought in 1915. The chief question involved in the action was whether failure of the company to give notice to the insured of the premium due in 1898, excused the failure to pay that premium and the marking of the policy on the books as lapsed, the failure to pay future premiums.

There was no statute in Indiana requiring such notice and the policy contained a provision to the effect that the giving of such notice should be considered only as a courtesy and should not be construed to establish a custom. The insured also had two older policies in the company upon which notices were given and the contention was that the giving of these notices, notwithstanding the provision in the policy, established a custom on which the insured had a right to rely. There was testimony that he had relied upon these notices.

The court held that, notwithstanding the provision in the policy, the giving of notice for many years did establish a custom and that "such a provision as the one above mentioned must not be allowed to prevail over a custom running through years of sending notices and with no warning to appellee that he would no longer receive such notices." It allowed the insured the cash surrender value, which was one of the options at the end of the fifteen-year dividend period in 1907, together with interest from 1907, less unpaid premiums with interest thereon. This option was one which according to the contract could only have been elected if

election was made at least three months prior to the end of the period.

Effect of Insanity on Requirement of Proof of Disability: —(Marti *vs.* Midwest Life Insurance Co., Supreme Court of Nebraska, 189 N. W. Rep. 388.) The policy provided that in case the insured became totally and permanently disabled he had, after satisfactory proof of disability, as one of several options, the right to retain the policy as a fully paidup policy for the full amount. The insured became totally and permanently disabled through insanity and after this the policy lapsed, no proof of disability being furnished until after the death of the insured. The beneficiary had no knowledge of the existence of the policy. The question was whether the policy lapsed through the non-payment of premium or if the notice by the beneficiary and selection of this option when she learned of the existence of the policy, although this was after the death of the insured, was sufficient to make the policy in force at his death.

The court held that since the insured was, because of insanity, unable to furnish the proof required of the disability and make the election of the option, and the beneficiary was also unable to do this because of lack of knowledge of the existence of the policy, the delay not being due to any fault of either, the policy was in force at the death of the insured.

Accidental Death: Burden of Proof:—(Watkins *vs.* Reliance Life Insurance Co., Supreme Court of Arkansas, 238 S. W. Rep. 10.) The policy provided for an additional payment if the insured should die as the result of bodily injury "effected solely through external, violent and accidental means." The insured shot himself, either intentionally or by accident, and the company claimed that death was by suicide.

The opinion of the court held that it was proven that death was caused by external and violent means and it was not necessary to prove the accidental means, but that the presumption against suicide threw the burden on the company of overcoming such presumption.

Death "from Bodily Injury Effected Solely Through Accidental Means":—(Kimball *vs.* Massachusetts Acc. Co., Supreme Court of Rhode Island, 117 Atlantic Rep. 228.) The policy

was an accident policy providing, among other things, indemnity for death "from bodily injury effected solely through accidental means" which was further limited by the specific provision that the policy should not cover death from disease. The insured had a boil or abscess on the back of his neck in which erysipelas developed causing his death. The bodily injury which the deceased had, was this open boil or abscess but there was no testimony to show that its open condition or the erysipelas infection was the result of accidental means.

The decision of the lower court in favor of the company was upheld. In the course of the opinion the distinction was made between accidental means and an unexpected result of a deliberate and intentional act.

SUICIDE: DIRECTED VERDICT:—(Deweese *vs.* Supreme Camp W. O. W., Supreme Court of Kansas, 204 Pacific Rep. 523.) The order denied liability on the ground of suicide. The insured was found hanging in a house which he was building for himself. In a notebook in his pocket this note appeared:

"Notify Mrs. Bessie Deweese, 367 South Tenth Street. Please don't take much expense with my burial. Good-bye, and take care of the children. Trouble and worry caused this.

Luther Deweese."

There were no marks of violence other than those caused by the hanging, and nothing to indicate murder. The jury in the lower court gave a verdict against the order. The Supreme Court reversed this and directed a judgment entered in favor of the order on the ground that there was but one sensible or reasonable conclusion to be derived from the evidence in the case.

FALSE REPRESENTATION IN REINSTATEMENT OF POLICY:—(American National Insurance Co. *vs.* Robinson, Supreme Court of Oklahoma, 204 Pacific Rep. 269.) The policy lapsed and was restored and the insured died shortly thereafter. The claim was contested by the company on the ground of fraud in procuring restoration. The policy contained a one-year incontestability clause, and more than one year had elapsed from the date it was originally issued. The company took the position that the reinstatement of the policy was tantamount to a new contract and that it could consequently set up fraud in obtaining reinstatement, at any time within one year after reinstatement. Copy of the applica-

tion for reinstatement, however, was not attached to the policy. The Oklahoma statute contained a provision as follows:

". . . Provided, further, that every policy which contains a reference to the application of the insured, either as a part of the policy or as having any bearing thereon, must have attached thereto a correct copy of the application, and unless so attached the same shall not be considered a part of the policy or received in evidence."

The court held

"If we treat this as a new application, and the reinstatement tantamount to a new contract under this statute, the application not being a part of the policy, although the policy refers to the application for reinstatement, the plaintiff in error could not introduce the same in evidence, nor can it be considered a part of the policy, because a copy of the application was not attached to the policy. If plaintiff in error desired to reserve the right to contest the statement made in the application, it is its duty to follow the statute and make said application a part of the policy, and attach a copy thereto; otherwise they would not be entitled to introduce the same in evidence."

The judgment against the company in the lower court was affirmed. In doing so the Supreme Court stated specifically that it did not decide the question whether the reinstatement of the policy was tantamount to a new contract.

"VEXATIOUS REFUSAL TO PAY":—(Bennett *vs.* Standard Accident Insurance Co., St. Louis Court of Appeals, 237 S. W. Rep. 144.) The policy was an accident policy. The insured received injury, resulting in total disability, from inhaling gas under circumstances which were strongly suspicious of attempted suicide. A judgment was given against the company in the lower court and this was appealed. The judgment included an additional amount of approximately 50 per cent. for attorney's fees and damages for "vexatious refusal to pay." The St. Louis Court of Appeals stated in the opinion that while the evidence was such that a demurrer on the part of the company was properly overruled the circumstances pointed strongly to the fact that the insured attempted to commit suicide and that the company "had reasonable cause to refuse to pay the loss and the right of litigating the question without being penalized."

Judgment was reversed and the cause remanded because of conflicting instructions to the jury in the lower court, and it was stated that if at the retrial the evidence was the same, the court should not submit to the jury the issue of vexatious refusal to pay.

Book Reviews and Notices.

The Mathematical Theory of Probabilities. Arne Fisher. Second Edition greatly enlarged. The Macmillan Company, New York, 1922. Pp. xxix + 289.

This book may be said to be the first attempt to cover in English the present field of mathematical probability, so as to include recent developments in social and biological statistics along with the classical problems in Choice and Chance, and with the theory of the normal curve of error. Probably the most complete discussion hitherto is Professor Edgeworth's article in the Encyclopaedia Brittanica, which is necessarily condensed. Of especial value are the extensive references to the work of the Scandinavian mathematicians, too little known on this side of the Atlantic.

Starting with brief notes on the philosophical and historical aspects of the subject, the book proceeds through the usual fundamental theorems, Bayes' Rule, the Law of Large Numbers, etc., to a discussion of Bernoullian, Poisson, and Lexis series, with criteria for putting actual observed homograde series into one of these three classifications. The characteristics of the three types are clearly explained, but the discussion of the procedure to be followed once a series is classified requires more careful reading. The application of the theory could have been made clearer.

The remainder of the book deals with frequency curves and heterograde statistics (those in which an attribute is measured quantitatively, rather than merely recorded as present or absent), with practical applications chosen from various statistical fields. Frequency curves are stated to fall into two types which the author introduces as Types A and B, but later calls Gram-Charlier and Poisson-Charlier Series. In this connection the prospective reader should be warned that the author is prone to state important facts in obscure places; and the chapter and section headings are not always definite enough to locate an elusive passage. For example, the Type A curve is first mentioned in a historical section. The name of Gram is brought in, and then suddenly the reader is confronted with references to the "Gram-Charlier Series." A rereading of the preceding sections reveals no definition of the

term "Gram-Charlier Series" nor is it mentioned in the table of contents. After more or less study the reader derives his own definition by inference.

This, and the previously-mentioned failure to clarify the connection between theory and practice, are not serious when the book is read leisurely by a student conversant with the methods used. But they do impair its value as a textbook, or as a work of ready reference for the scientist whose knowledge of probabilities is rusty.

The student's difficulties in following the reasoning will not all be due to the arrangement and language. The proof-reading has not been up to the standard desirable in a mathematical book, and more than once a difficult step is made worse by a typographical error in a formula. The reader will save time by looking for misprints when a passage perplexes him.

In view of the wide range of topics covered it might be wished that Mr. Fisher had not omitted certain matters which are commonly included in the subject, e.g., correlation, local or geometrical probability, and the probability of a deviation within certain limits when the frequency curve is the normal curve of error.

A feature of the book is the replacement of the Method of Moments by a peculiar system of functions invented by the Danish mathematician Thiele, and called semi-invariants.

The discussion of Bayes' Rule for inverse probabilities, or as Mr. Fisher prefers to call them *a posteriori* probabilities, is commendably clear. Various paradoxes which have arisen in the use of the rule, and which have caused the theory of probabilities to be called "the scandal of mathematics," are shown to be due to incorrect assumptions and not to the rule itself.

Mr. Fisher has unfortunately departed in several passages from the dignified tone customary in scientific works, and indulged in sharp and not always relevant personal criticisms of contemporary writers. The nature of these attacks is almost incredible; in the language of the real estate market, they must be seen to be appreciated.

The occasional references to actuarial science are interesting. The familiar Text Book definition of the probability of survival comes in for criticism on the ground that the lives exposed are not "equally likely" as in the sense of games of chance. It may be questioned, however, whether even the conventional balls in the

conventional urn are equally likely when all the physical facts concerning them are known. Pursuit of this line of criticism seems to lead into metaphysics, without particular profit to the practical actuary.

Mr. Fisher illustrates one of his points by breaking the graduated A.M.$^{(5)}$ table into the sum of two Gram-Charlier curves, but claims no biological significance for the result. He promises, however, to show in a forthcoming book that mortality tables can be constructed from mortuary records by sex, attained age, and cause of death, without reference to the exposure. The publication of this method will be eagerly awaited.

Unemployment Insurance in Theory and Practice. National Industrial Conference Board, New York. Research Report No. 51. 1922. Pp. 120.

The majority of the publications upon unemployment insurance have been written from the standpoint of either the socialist or the social worker. This report deals with the practical experience on unemployment insurance throughout the world from the standpoint rather of the individualist. The point of view throughout is that of the tax-payer who is required to find the money to support any such scheme.

It is perhaps inevitable that the theory of unemployment insurance is dealt with only in general terms. The theoretical part of the book consists of little more than a differentiation between unemployment insurance and unemployment relief.

For the student the interest of the book lies in the description of the various systems which have been adopted in one country or another for relieving unemployment through funds contributed in part by the persons who are being relieved. These systems are dealt with in three groups: voluntary mutual benefit schemes, subsidized voluntary organizations, and compulsory or social insurance. A fourth type—what might be called private insurance, carried by firms for the benefit of their own employees—is described in the section dealing with the United States in particular, but unfortunately the authors make no statement as to whether such schemes have been found in other countries.

In the section dealing with mutual benefit schemes, the actuarial student will notice with interest the usual assumption that Fraternal Societies in the United States are of the same type as

the British Friendly Societies. The latter existed mainly for the purpose of paying benefits to those of their members who were prevented from working by physical incapacity arising from sickness or accident. It was a very slight extension to allow in times of stress some portion of the funds to be used to enable the unfortunate among their members to find work. The Fraternal Societies of America on the other hand are, in practice, usually little more than life insurance organizations either of the assessment or regular type. It will be difficult for such an organization to handle unemployment insurance unless it also provides for benefits arising from physical incapacity.

Little need be said of the second type—subsidized voluntary organizations. These differ little from a special unemployment dole to the thriftier portion of the unemployed population. As a means of dealing with the mass of the unemployed population they appear to be of no value.

The third group consists exclusively of a description of the British unemployment legislation, together with a summary of the statistics relating thereto. This section gives an admirable picture of the working of a unique piece of legislation, in both its strength and its weakness. The bringing together of figures scattered through many different British official publications is in itself an important piece of work. We must however disagree with the conclusion of the authors that the present insolvency of the scheme arose from a catastrophe for which no provision could have been made. To our mind the insolvency was due rather to the fact that the number of insured employees was raised from something under five million to something over twelve million after the commencement of what may be regarded, from the standpoint of unemployment, as analogous to an epidemic. The causes of this arrangement were purely political and the authorities were certainly aware of the inevitable consequences.

The latter section of the book, which deals with the United States only, describes the various existing provisions for unemployment, including some half dozen schemes in use by private individual employers, the possibility of compulsory unemployment insurance in the United States, and the statistical basis available. The provisions of pending legislation in Pennsylvania, Massachusetts and Wisconsin are also described.

Tables of the Incomplete Gamma-Function. Edited by Karl Pearson, F.R.S. H. M. Stationery Office, London, 1922. Pp. xxxi + 164.

When the well-known work "Tables for Statisticians and Biometricians" was issued in 1914, Professor Karl Pearson, its editor, expressed the regret that the volume did not include the tables of the Incomplete Γ-function. These tables have at last been issued in a separate volume, and scientific computers in every field of statistical investigation will welcome this monumental work. The computations have been executed in the Biometric Laboratory of the University of London, the Editor stating in the Introduction that "hardly any worker in the Laboratory during the last ten years has failed to contribute in some way to the progress of 'Gamma.'"

It will be recalled that the *complete* Gamma-function, denoted by $\Gamma_\infty(p+1)$, or simply $\Gamma(p+1)$, is the value of the definite integral

$$\int_0^\infty e^{-v} v^p dv.$$

When the upper limit is not infinite, the Gamma-function is called *incomplete* and is denoted by

$$\Gamma_x(p+1) = \int_0^x e^{-v} v^p dv.$$

A whole century has passed since tables of the complete Γ-function, $\Gamma(p+1)$, were published by the great mathematician Legendre, and now his work is supplemented by the tables of the present volume.

In the introduction we find four sections: (I) definitions and explanations of symbols, (II) history of the present tables, (III) instructions as to use of the tables, and (IV) illustrations of the use of the tables. The most important tables in the volume are the first three. For theoretical as well as for practical reasons, the function tabulated is not the incomplete Γ-function itself, but the ratio of the incomplete to the complete function, denoted by

$$I(x, p) = \frac{\Gamma_x(p+1)}{\Gamma_\infty(p+1)},$$

or more correctly, the $I(u, p)$-function which is the ratio

$$\int_0^{u\sqrt{p+1}} e^{-v} v^p dv : \int_0^{\infty} e^{-v} v^p dv.$$

Table I, occupying pages 1–115, gives the $I(u, p)$-function for positive values of the argument p from 0 to 50 and of the argument u from 0 to 17; Table II, on pages 117–138, gives the same $I(u, p)$-function for negative values of the argument p from -1 to 0 and of the argument u from 0 to 51; and Table III, on pages 139–151, furnishes the function $\log I'(u, p)$ for values of the argument $p = -1$ to $+10$ and of the argument u from 0 to 1.5, where $I'(u, p)$ denotes $(1/e^{u^2})\, I(u, p)$, so that $\log I(u, p)$ may be easily obtained from the formula

$$\log I(u, p) = \log I'(u, p) + (p+1) \log u.$$

The volume is unique in two respects: it is the first publication which contains extensive tables of a function of two variables, and then, it establishes a noteworthy precedent of supplying the tables with central differences. It should be in the hands of every scientific computer, whether in physical or in economic investigations, who has occasion to apply the higher theory of probabilities.

Wealth and Income of the American People. Walter Renton Ingalls. G. H. Merlin Co., York, Penn-sylvania, 1922. Pp. xiv + 321.

This book bears the sub-title: "A Survey Of The Economic Consequences Of The War." It carries the survey of conditions through to the end of 1921. The total production in the United States from 1911 to 1920 is analyzed, together with the actual wealth of the country over the period and the change in status during the war years.

Many of the figures are necessarily approximations, characterized by the author in engineering language as "horseback survey." The basis for all of the estimates is, however, given in detail and the results are checked as far as possible with the conclusions of various economists and with the recent report of the Bureau of Economic Research.

The author finds that "previous to 1914 the American people

had been for several years realizing a gross income of about $33,000,000,000 per annum, out of which they had been saving about $7,000,000,000 per annum, which was put mainly into "railways, houses, public utilities, manufacturing plants, mines, etc." From 1917 through 1920, however, although the annual national income was greatly increased, almost all of the net income went into war costs, plant extensions built for war purposes and no longer useful, or foreign loans and other balances of doubtful value. In consequence, despite the gold received from Europe, the country's wealth at the close of the War period was little greater that at the beginning, and per capita was less. As the author remarks—"The whole supposition about the United States becoming rich out of the War was founded upon annual profits in terms of steadily rising prices and subsequently neglecting to offset them on the shrinkages of a foreign market and failing to take into account the cost of the War itself and the consequential losses that ensued."

Analyzing the physical property of the United States in detail, the author finds a considerable gain in such items as furniture, clothing, jewelry, and automobiles—particularly the latter. All of this group are things that are consumed with more or less rapidity and many may be classed as "luxury goods." On the other hand the value of such things as buildings, mines, and electric railways has decreased.

Looking ahead he foresees that as deflation continues, expenditures for government and luxuries must be curtailed or else the country will be in the position of living on its principal. Unless a lower standard of living is accepted today the failure to accumulate capital will prevent future advances, and will in the long run compel the acceptance of the reduced standard.

Consideration is given to such subjects as the cancelation of the allies' debt, the results of Socialism and Communism, the future of Labor Unions, and the responsibility of those whose economic function is to manage.

The immediate interest of the book for insurance men arises out of the connection between the supply of and demand for capital on the one hand and interest rates on the other. By introducing the human element and referring to the motives and lines of thought which govern spending and saving, the author throws light on this subject which no mere tables or graphs could give.

Some of his conclusions are debatable, such as that deflation will continue in the immediate future beyond the point which it has reached at the present time. The book, however, is well reasoned and its viewpoint is fresh. It invites thought, and is well worth discussion.

Facing Old Age. A. Epstein. A. D. Knoff Co., New York, 1922.

Mr. Epstein as Director of the Pennsylvania Commission to Investigate Old Age Pensions had the opportunity to review and analyze the findings of this Commission. He has accordingly published this volume "Facing Old Age" as a direct result of his connection with the Commission and he presents nothing new in this volume which was not previously in the report of the Commission itself, save a general suggestion of state pensions given outright to the old citizens. There is back of the whole volume an obvious sincerity, a feeling of hearty goodwill toward the working class and an assumption hardly backed up by any real statistical data that men today are eliminated from industry at an earlier age than formerly and that state pensions in old age would raise the standard of living in the meantime.

The mathematical, or rather the cost side of the old age pension question he hardly touches and we should not consider his book any real assistance in determining old age policies, although it is as good a reference work for the plans of other countries as was the report from which it draws its material. (Reviewed in the *Proceedings of the American Statistical Association*, September, 1922.)

Income in the United States. National Bureau of Economic Research, 1922.

The National Bureau of Economic Research, Incorporated, was chartered in 1920 to conduct quantitative investigations into subjects which affect public welfare. The aim of the Bureau is "to ascertain fundamental facts within its field as accurately as may be, and to make its findings widely known." The Bureau has 19 directors including such individuals as Professor Commons of the University of Wisconsin, President Gay of the New York Evening Post, Harry W. Laidler, Secretary of the Intercollegiate Socialist Society, Professor Young of Harvard University, George E. Rob-

erts of the American Bankers' Association and Hugh Frayne of The American Federation of Labor.

The present volume estimates the size of the National Income in two ways—first, from the income tax returns, reports on wages and salaries, investigations of the profits of farmers, and the like; the other, statistics of coal and metals mined, lumber cut, crops grown, raw materials transported or manufactured, and so on.

The chapter on the distribution of the National Income is one which if the essential accuracy of the methods is admitted will be of great interest in various social discussions. First is shown the percentage of the "net value product" (or income less expenses of production other than wages and salaries) of various industries received by employees in the form of payment for services where in all industries this figure is over 50 per cent., but ranging from under 15 per cent. in agriculture to over 70 per cent. in production of minerals and in factories. A better division, however, is subsequently shown of the net value product of mines, factories and transportation into earnings of employees and compensation for management and the use of property, with a further distinction between the salaries of officials and of general employees.

Construction of Mortality Tables from the Records of Insured Lives. Actuarial Studies No. 2. Principal Contributors, R. D. Murphy and P. C. H. Papps. The Actuarial Society of America, New York. 1922. Pp. 72.

Students for Part I of the Fellowship examination will welcome the appearance of this volume. "Exposed to Risk" formulae have, we believe, been a bugbear to many actuarial students. This has been partly because of the complexity of the subject, at least in the days before the invention of Select Tables when "life years" and "calendar years" made equal claims for consideration with "policy years," and partly because of the lack of a clear and simple discussion of the subject as a whole. In recent years some excellent material has been available. The well-known article on "Mortality Tables" by Mr. W. A. Robertson in the Encyclopaedia of Accounting gives an admirably clear epitome of the rationale of exposed to risk formulae while the more recent book by W. P. Elderton and R. C. Fippard has provided a readable introduction to the subject of insurance mortality tables from an elementary and non-technical point of view. These, with Mr.

Henderson's monograph on "Mortality Laws and Statistics," are, however, perhaps not readily accessible to some of our students and there is therefore room for the present volume.

The contributors have provided a very useful and comprehensive survey of the subject dealt with and one which will no doubt be of use to all members of the society as a work of reference. In fact, we are inclined to think that it may have greater value in that way than as a textbook. For the latter purpose it is, possibly, somewhat condensed and, as the authors indicate, a full reading of the official descriptions of the methods used in such investigations as the American-Canadian and the British Offices is a necessary sequel to the reading of this book. From these the student will get full information as to the handling of the many problems of practical detail which arise in actual work. The discussion of the "life year" and "calendar year" methods may be sufficient in view of the now much greater importance of the "policy year" method and it may save the student some unnecessary research.

The authors are to be congratulated upon having provided a concise and readable summary of a difficult subject and a volume which is a notable addition to the publications of the Actuarial Society.

Other Recent Publications.

Banking and Credit. D. R. Dewey and M. J. Shugrue. Ronald Press, New York, 1922.

Business Mathematics. E. I. Edgerton and W. E. Bartholemew. Ronald Press, New York, 1921. Pp. 305.

Calculus and Graphs Simplified for a First Brief Course. L. M. Passano. Macmillan Company, New York, 1921. Pp. 167.

Catalogue of Insurance Publications, American and Foreign. The Spectator Co., New York. 12th Edition. 1922.

Directory of Insurance Lawyers, Adjusters and Medical Examiners. C. C. Hines Sons Co., New York, 1922.

Federal Income Tax Primer. Financial Publishing Co., Boston, 1922. Pp. 164.

Foreign Exchange. E. S. Furniss. Houghton Miflin Co., Boston, 1922.

Health Service in Industry. W. I. Clark. Macmillan Co., New York, 1922.

Illinois Standard Tables. Fackler & Fackler. The Spectator Co., New York, 1922.

Monetary Reconstruction. C. B. W. Strover. The Author, Chicago, 1922.

Perpetual Accrued Interest Calendar. A. J. Lundberg. The Author, San Francisco, 1922.

Property Insurance. S. S. Huebner. Appleton & Co., New York, 1922.

Public Relief of Sickness. G. Morgan. The Macmillan Co., New York, 1922.

Ready Reference Digest of Accident and Health Insurance Law. M. W. Van Auken. Bender & Co., New York, 1922.

Selected Articles on Social Insurance. J. E. Johnsen. H. W. Wilson Co., New York, 1922.

Sinking Funds, Reserve Funds and Depreciation. J. H. Burton. Pitman & Sons, New York, 1922.

Standard Table of Short Term Calculations. Compiled by N. D. Sterling, New York, 1922.

Statistics of Fraternal Societies. Fraternal Monitor Company, Rochester, 1922.

The Investment Laws Relating to Insurance Companies. C. W. Hobbs. Wright & Potter, State Printers, Boston, 1921. Pp. 53.

Total Permanent Disability Benefits, Net Rates and Reserves. I. P. Mantz & P. N. Mantz. The Authors, Des Moines, 1922.

Why Play the Game to Lose? (Life Insurance.) C. A. Gibson. The Author, Indianapolis, 1922.

ABSTRACTS FROM THE MINUTES OF THE SEMI-ANNUAL MEETING OF THE ACTUARIAL SOCIETY OF AMERICA, HELD IN HARTFORD, CONN., ON THURSDAY AND FRIDAY, OCTOBER 19 AND 20, 1922.

TRAVELERS BUILDING, October 19, 1922.

FIRST DAY.

The meeting was called to order by the President, Mr. Robert Henderson at 11 A.M.

The following members were present:

FELLOWS.

ALSOP, D. G.,
BAGLEY, W. N.,
BARBER, W. P.,
BASSFORD, H. R.,
BIRKENSHAW, J. H.,
BLACKADAR, W. L.,
BLEHL, E. M.,
BOOTH, R. I.,
BOWERMAN, W. G.,
BREIBY, WM.,
BUCHANAN, J. D.,
BUNYAN, A. T.,
CALE, C. E.,
CAMERON, W. J.,
CAMMACK, E. E.,
CANN, F. E.,
COBURN, A.,
COLE, R. H.,
COOPER, J. J.,
CRAIG, J. D.,
CUSHMAN, E. W.,
DARK, T. A.,
DAVIS, M.,
DOW, H. B.,
ELSTON, J. S.,
FACKLER, E. B.,
FACKLER, D. P.,
FILE, L. K.,
FITZGERALD, C. R.,
FLANIGAN, J. E.,
FLYNN, B. D.,
GAMERDINGER, C. W.,
GAYLORD, W. S.,
GERHARD, F. B.,
GIBB, J. B.,
GORE, J. K.,
HALL, S. S.,
HALLMAN, M. S.,
HARDCASTLE, E. E.,
HENDERSON, R.,
HENDERSON, E. C.,
HEZLETT, E. H.,
HOLCOMBE, J. M.,
HOLMES, H.,
HOSKINS, J. E.,
HOWE, L. H.,
HOWELL, V.,
HUENERGARD, A. J. C.,
HUNTER, A.,
HUNTINGTON, R. W.,
HURD, H. G.,
HUTCHESON, W. A.,
JACKSON, C. W.,
KATTELL, S. C.,
KILGOUR, D. E.,
KING, W. I.,
LAING, J. M.,
LAIRD, J. M.,
LARUS, J. R.,
LINTON, M. A.,
LITTLE, R.,
MCCONAGHY, C. A.,
MCKECHNIE, J. B.,
MABON, J. B.,
MACAULAY, T. B.,
MACFARLANE, W.,
MACLEAN, A. T.,
MARSHALL, E. W.,
MEAD, F. B.,
MOIR, HENRY,
MORRIS, E. B.,
PAPPS, P. C. H.,
PEILER, M. H.,
PERRIN, O. W.,
PETTEGREW, A. A.,
PEQUEGNAT, A. E.,
PEIRCE, H. H.,
POWELL, J. M.,
RHODES, E. E.,
RICE, H. I. B.,
ROCHE, J. F.,
ROSE, D. H.,
RYDGREN, A. A.,
SHEPHERD, C. O.,

Smith, F. M.,	Thomas, E. M.,	Wells, D. H.,
Speers, A. A.,	Thompson, J. S.,	White, W. C.,
Stephenson, H. R.,	Torrey, M. W.,	Williamson, W. R.,
Stilwell, S. E.,	Walker, D. A.,	Wolfenden, H. H.,
Strong, W. M.,	Warters, D. N.,	Wood, A. B.,
St. John, H. W.,	Watt, W. A.,	Wood, W. A. P.,
Tarbell, T. F.,	Watson, A. D.,	Woodward, G. B.,
Tebbetts, J. W.,	Welch, A. A.,	Woodward, J. H.

ASSOCIATES.

Allstrom, H. W.,	Griswold, R. N.,	McCankie, R. C.,
Angell, C. H.,	Halliday, W. R.,	Macfarlane, J. A.,
Beers, H. S.,	Harrison, W. H.,	Miller, I. A.,
Beecroft, J. D.,	Herman, J. R.,	Moore, G. C.,
Bourke, G. W.,	Hill, E. B.,	Moulton, C. E.,
Bulkley, G. E.,	Holmes, Janet,	Reichgott, H.,
Buttolph, H. W.,	Hughes, C.,	Reid, E. E.,
Davenport, J. S.,	Jordan, F. R.,	Rowan, H. R.,
Dickenson, D. S.,	Kaufman, H. N.,	Skilton, G. W.,
Dowsett, R. E.,	Kelton, W. H.,	Stevens, L. L.,
Ehrenclou, O. A.,	Keys, M.,	Washburn, J. H.,
Fisher, J. W.,	Larkin, H. F.,	Washburne, A. C.,
Franks, J. B.,	Lithgow, J. H.,	Wheeler, R. P.,
Grout, H. A.,	Lundgren, E. A.,	Williams, Emma.

Mr. C. A. Elliott, F. I. A., Actuary of the Australian Mutual Provident Society of New South Wales, attended the meeting as guest of the Actuarial Society and was formally welcomed by the President.

The President, Mr. Robert Henderson, read his Presidential Address.

The minutes of the annual meeting held in New York on May 18 and 19, 1922, were approved without reading.

The Secretary read a report made by the Index Committee, in which it was recommended, in part, that a complete and continuous Index to the Transactions be made by an Assistant Editor under the supervision of the Editor, that a card index be maintained at the Society's rooms, and that an index be published for each ten volumes. This report had already been adopted by the Council.

The Society proceeded to the discussion of papers; the papers had been distributed in advance of the meeting and the discussions therefore appear in this number of the Transactions. This occupied the remainder of the day except for an intermission for luncheon at the Hartford Club where the Society was the guest of the Hartford Companies.

The meeting adjourned at 5:30 P.M. to assemble for dinner at the Hartford Club at 7 P.M.

At the dinner President Henderson acted as toastmaster and the speakers were the Honorable Burton Mansfield, Insurance Commissoner for the State of Connecticut and Mr. A. A. Welch, Vice President of the Phoenix Mutual Life Insurance Co. In addition to Mr. Mansfield the Society entertained as its guests Mr. L. F. Butler, President of The Travelers Insurance Co., Mr. H. S. Robinson, President of the Connecticut Mutual Life Insurance Co., and Mr. Frank Bushnell, Vice President, Aetna Life Insurance Co. The ladies accompanying members to the meeting were guests of the Hartford Companies, and an entertaining and novel programme was furnished by our hosts.

SECOND DAY.

The meeting was called to order in the Assembly Hall of the Phoenix Mutual Life Insurance Co., Elm Street, by President Henderson at 10 A.M., and was entirely devoted to the informal discussion of topics of current interest, as follows:

Selection.

(1) In view of the present condition of prohibition enforcement with especial reference to the illegal sale of alcohol and to the bad quality of that illegally sold, should there be any modification of the questions as to habits usually contained in the application blank? Should there be any change in the underwriting principles applied?

(2) In companies which use the "numerical rating" system, what is the procedure after the "rating" is fixed?

(3) In his paper entitled "Selection of Risks From an Actuarial Standpoint," Mr. Arthur Hunter gives (Transactions XII-6) a classification of risks in seven groups ranging from "very favorable" to "very unfavorable" and the "Ratio to Standard Select Table" for the mortality in each such group. To what extent is this table of ratios a guide to the average company? Has subsequent experience modified this table?

Substandard Business.

(4) In order to discharge its full duty to the community, should a life insurance company maintain a substandard department?

(5) Does the existence of a substandard department impair, in any way, the ability of a company to give the most efficient service to those eligible for insurance at standard rates?

Mortality.

(6) The aggregate mortality ratio of a life insurance company on the net amount at risk using the American Experience table

is $x\%$. What would it be likely to be on the basis of the American Men Ultimate table?

Premium Rates for Large Policies.

(7) Is it desirable to issue policies of large amount at lower rates of premium than for smaller policies on account of possible saving in expense?

(8) Are there any considerations justifying an expectation of more favorable mortality under large policies issued since 1919 than under similar large policies issued prior to 1915, say, for example, those examined and reported on in the American-Canadian Mortality Investigation?

Surrender Values.

(9) What principles should govern the calculation of surrender values in the early policy years? If the surrender values are made approximately equal to the "asset shares," should these "asset shares" be calculated on the assumption that the first year's expenses are to be charged against new policies only?

(10) Should surrender values be granted under any consideration at the end of the first policy year? Is it consistent to allot dividends at an earlier stage in a policy's history than that at which cash or other surrender values are allowed?

Conversions, Changes, "Twisting."

(11) If a life or endowment policy is surrendered and a new policy in the same company taken out to replace it, what modification, if any, should be made in the agent's commissions on the new policy? Should the rule be varied under different conditions, and if so, how and why?

Disability Benefits.

(12) Is the "90-day clause" under which any total disability continuing at least that period is considered permanent, a desirable addition to the usual disability clause from the standpoint of (*a*) the company and (*b*) the policyholder?

(13) A common feature of the contract definition of total and permanent disability benefits is inability to "perform any work for compensation, gain or profit." Are there any other or more satisfactory methods of defining disability? Is there any way of defining the disability of a person not engaged in an occupation for "compensation, gain or profit," such as a schoolboy, a retired merchant or a married woman not engaged in business?

(14) If the holder of a life insurance policy with a disability clause becomes totally and permanently disabled, but is retained on the payroll of his employer, is he eligible for total and permanent disability benefits?

(15) The premiums on certain old policies contain a nominal additional premium of about $0.25 per $1,000 insured for disability benefits which cease at 60. Is it necessary to reduce the gross premiums on such old policies at the time when benefits expire?

Additional Accidental Death Benefits.

(16) Since the incorporation of the "Double Indemnity" clause in life policies, has there been any increase in the suicide death rate in the first policy year through the inclusion of questionable suicide cases?

(17) Should proofs of death be amended so as to determine additional details if death appears to have been caused by accident or should supplementary proofs be used?

(18) Should restriction against payment of double indemnity be imposed in event of death arising from an insect bite?

Taxation.

(19) Are Inheritance Taxes payable upon the proceeds of a life insurance policy paid for from funds left in trust for a beneficiary?

Pension Funds.

(20) Assuming a pension plan of the type according to which employees' contributions are accumulated at interest and converted at retirement into a life annuity, should the amount of such annuity purchased by the unit of accumulations be guaranteed to employees who will not retire for 30 or more years? If so, what is the maximum rate of interest at which the amount of annuity should be calculated; if not, for what period, if any, may the present annuity rates be guaranteed to be maintained?

At the termination of the informal discussion a hearty vote of thanks was tendered the Hartford Life Insurance Companies—Aetna, Connecticut General, Connecticut Mutual, Phoenix Mutual and Travelers—for their hospitality and entertainment. The appreciation of the members of the Society may be judged from the circumstance that there was at this meeting a record attendance of both members and guests.

At 12 o'clock the Society adjourned for luncheon at the Hartford Golf Club as guests of the Hartford Companies. The afternoon was devoted to the enjoyment of a well-planned programme of entertainment at golf, tennis and motoring.

Results of Examinations.

The following is a list of those who passed the examinations held by the Society on May 25 and 26, 1922:

ASSOCIATESHIP.

Part I.

Ashman, Carl R.
Auden, Marcus F.
Babbitt, Albert E.
Bayly, Richard C.
Bell, David W.
Bell, Max S.
Blackburn, Casper K.
Brady, George V.
Bryce, George M.
Budinger, Joseph A.
Cameron, John L.
Compeck, Paul W.
Cunningham, Frederick J.
Dobson, Richard
Doxsee, Morley
Driscoll, Frederick M.
Eddy, C. Manton
Fawsett, Walton B.
Fisher, Angela D.
Folz, Clifford H.
Gill, Ernest C. (Cum laude)
Green, Chandler T.
Guy, Harrington L.
Henry, Eva M.
Hohaus, Reinhard A. (Cum laude)
Holmes, Benjamin T.
Housego, James W.
Hyndman, William W.
Jackson, Clara M.
Knapp, Royal A.
Kenigson, Abraham
Klem, Walter
Langellotti, Frank
Linder, Joseph
McAndless, Alva J.
Montague, Hill, Jr.
Peebles, Allon
Pettengill, Robert B.
Poorman, William F.
Price, Frederick L.
Relyea, Frank B.
Riter, Harold E.
Russell, James B.
Schwartz, Adolph F.
Sharp, Jonathan G. (Cum laude)
Springer, Harold M.
Stagg, Ronald G.
Steacy, Russell G.
Stockdale, Jean F.
Strindlund, Lawrence W.
Studley, Bennett D.
Thompson, Sanford McD.
Tousaw, Albert A.
Toye, Grace E.
*Turnbull, John
Unsworth, Norman R.
Walsh, James V.
Winters, Herbert A.
Wright, Byron

Part II.

Abbott, Eleanor A.
(Magna cum laude)
Albright, Lucille M.
Armstrong, Ewen C.
Bell, David W.
Bell, Max S.
Berger, Edla G.
Berger, Nanda M.
Booke, Samuel
Brady, George V.
Bryce, George M.
Budinger, Joseph A.
Burian, Otto J.
Cameron, John L.
Dobson, Richard M.
Fisher, Angela D.
Folz, Clifford H.
Garabedian, Harold A.
Gill, Ernest C. (Cum laude)
Gilmour, Neil (Cum laude)
Guest, Richard C.
Henry, Eva M.
Hohaus, Reinhard A.
(Magna cum laude)
Hollenberg, Max R.
(Cum laude)
Jackson, Clara M.
Johanson, Francis O.
†Johnson, Arthur W.
Johnson, Esther
Kenigson, Abraham
Kineke, Frank D.
(Cum laude)
Lienhard, John B.
Linder, Joseph
Marsh, Anna
Marsh, John A.
†Michner, Samuel M.
Neil, John B.
Paisley, Aylmer B.
Poorman, William F.
Prentice, George F.
Relyea, Frank B.
Russell, James B.
Russell, William A.
Schwartz, Adolph F.
Sharp, Jonathan G.
(Cum laude)
Smith, L. Gordon
Sosnow, George Y.
Taylor, Charles A.
†Tookey, Clarence H.
West, Charles A.
Wickes, Haines B.
Wood, John A.
Wright, Byron

Part III.

Albright, Lucille M.
Armstrong, Ewen C.
Barnsley, Reginald C.
Corcoran, William M.
Dalrymple, James R.
Dodd, Thos. K.
Darkow, Marguerite D.
Ehrenclou, Orvar A.
Geddes, George W.
Herman, James R.
Jackson, Henry H.
Jacoby, Oswald N., Jr.
Kolodny, George
Marshall, Gladstone
Martin, Leslie R.
Menagh, Louis R.
Morrison, Henry P.
Murray, John G.

Palmer, Gertrude L.
Phillips, James T.
Pike, Morris
Porter, Louis A.
Robbins, Rainard B.
White, James E.
Williams, Emma T. R.

PART IV.

Barnsley, Reginald C.
Bourke, George W.
Cronin, Sarah E.
Ehrenclou, Orvar A.
Geddes, George W.
Harrison, William H.
Herman, James R.
Holmes, George L.
Holmes, Janet
Jackson, Henry H.
Jacoby, Oswald N., Jr.
†Keffer, Ralph
Kolodny, George
Morrison, Henry P.
Phillips, James T.
Porter, Louis A.
Skilton, George W.
Stewart, Alice M.
Stowe, Hudson J.
Warren, Lloyd A. H.
Williams, Emma T. R.

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Peirce, Harry H.
Porter, Elder A.
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† Part I. Not yet passed.
* Part II. Previously passed.
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